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Original Communications

AGE PERIOD CHANGES IN THE CERVIX UTERI WITH SPECIAL REFERENCE TO CANCER DEVELOPMENT*

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INTRODUCTION

THE characteristic histologic structure of the cervix uteri with its two distinct types of lining epithelium and tortuous racemose glands dipping down into the stroma, introduces into its tissue constitution a peculiar susceptibility to cell disturbances. Moreover, its physiologic history and the traumas and "chronic inflammations," to which it is particularly exposed after parturition, furnish the necessary internal and external factors for abnormal and atypical growths. It is therefore not surprising to note the frequent occurrence of cancer in the cervix. The corpus uteri, possessing only one characteristic epithelium with a tubular type of gland, fulfilling a more constant and uniform function, is apparently not apt to develop atypical qualities.

Authorities are agreed that the uterus is the most frequent location of all cancers occurring in women, and that the cervix is most commonly involved. About one-third of all female atypical tumors are cervical cancers. Ewing,[1] Peterson,[2] and Anspach[3] find that about 90 per cent of cancers of the uterus occur in the cervix.

It has been quite definitely established by clinical evidence, that an endocervicitis is the forerunner of cervical cancer, although this is not yet fully accepted by pathologists. In the so-called "precancers" very suggestive pictures of potential cancers and incipient cancers

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have been shown, but there has not been demonstrated a fully conclusive sequence from normal tissue into genuine cancer.

The cervix, therefore, assumes a very important rôle in cancer prophylaxis, particularly since it is so much more readily accessible for frequent examination as compared with the corpus.

In this paper a detailed histologic study has been made of cervices of the different age periods, so as to gain a comparative view of the cell changes and their possible connection with the histogenesis of early cancer. No emphasis, therefore, is laid on the demonstration of actual cancerous tissue, but rather on the events leading up to its development. Particular attention is of course given to the epithelial linings and glands, and less consideration to the other parts of the cervix.

TECHNIC AND MATERIAL

Routine examination of cervices has been made but the material for this study does not necessarily come from consecutive patients, as some was derived from autopsy subjects and some from specimens removed for various surgical reasons. Sections were stained in hematoxylin-eosin, following the usual laboratory procedures. No study has been made of the specimens grossly, as only the histology has been considered. Care has been taken to overrule artefacts caused by sections being cut at various planes. This has been done by the study of serial sections (about every tenth one being stained) and by careful differential diagnosis of the cells.

In all, 124 specimens have been stained, 24 autopsy cervices, and 100 surgical cases, chiefly inflammatory. They have been arranged according to the various age periods; viz., 1, fetal; 2, infantile; 3, adult, and 4, senile. Examined according to age, there were as follows:

1st decade	7 specimens
2nd decade	2 specimens
3rd decade	15 specimens
4th decade	49 specimens
5th decade	31 specimens
6th decade	13 specimens
7th decade	7 specimens
	124

RESULTS

1. *Fetal Period.*—The fetus well illustrates the many evolutionary aspects which the lining membrane of the portio and the endocervix present even before birth. Indeed it is an early example of the remarkable instability of the cervical lining membrane and the facility of interchangeability or metaplasia of its two types of cells.

During the first months of intra-uterine life there is no differentiation in the lining epithelium between the uterus and vagina; and the

portio is not in existence. About the fourth or fifth month there is an evolution of the vaginal epithelium into the squamous type, and this gradually progresses upward until the lower part of the cervix has been penetrated by squamous epithelium.

From the sixth month on, the cervix begins to assume its characteristic mucous epithelium, and this gradually pushes out the invading squamous tissue from inside of the cervix. Thus the dividing line between the columnar and squamous types of cells comes to lie at the external os. In this process of differentiation, a series of abnormalities can appear. Thus, rests of basal squamous epithelium may remain behind the mucous lining and later, according to the investigations of some writers, can undermine the columnar epithelium and produce so-called "metaplasias." Also the squamous epithelium may remain
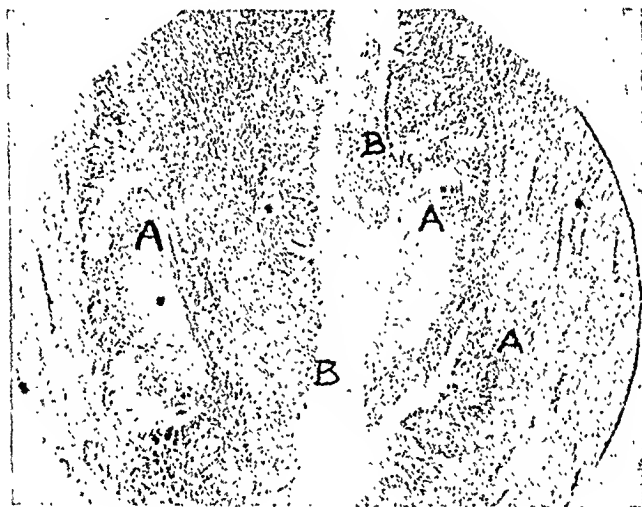

Fig. 1.—Cervix from infant three days old. View of endocervical portion. Illustrates a persistence at birth of an abnormality in fetal evolution, in which invading squamous epithelium, growing in from below as usual, has penetrated the endocervix deeply, remained behind, but has not been displaced by the downgrowing mucous epithelium of the cervix. A, is the persistent squamous epithelium of the portio, replacing B, the typical mucous columnar epithelium of the endocervix.

intact inside the cervix for a considerable distance upward, passing the usual boundary line of the external os. The columnar epithelium in its downward path sometimes oversteps the external os and reaches the portio (congenital erosion). (See Fig. 1.)

Fischel[4] found these congenital erosion patches to possess crypts and glands, thus proving them definitely developmental malformations. He believed that these remains could continue on in later life and be the basis for the formation of adult erosions.

2. *Infantile Period.*—Compared to the adult, at birth the lining epithelium of the endocervix shows relatively higher columnar cells with their nuclei removed some distance from the basement membrane; the glands are fewer in number.

A variable time later on in infancy the columnar cells begin to assume the adult appearance. In this series in sections from infants three weeks old, there is noticed in parts a descent of the nucleus toward the base of the cell, although for the most part the cells are still infantile in character; while at two and a half months of age the fully developed adult type is apparent.

3. *Adult Period.*—Under this heading can be grouped from a histologic viewpoint the prepuberty, puberty, nonpregnant, and pregnant adult cervices up to the menopause. There is little direct effect by these various physiologic influences on the cervix, which is inactive and receives only passive results.

During menstruation the cervix is unchanged. In pregnancy, the connective tissue becomes softened and the muscle fibers become longer, with the cervical glands secreting more mucus (Frank[5]). Williams[6] attributes the slight increase in size of the cervix to the increased hyperemia and notes very little hypertrophy of the muscle fibers.

Although pregnancy in itself does not materially alter the cervix, the after-effects of parturition are very important and far-reaching as regards the genesis and development of cancer.

Williams[6] states that slight degrees of cervical laceration must be regarded as an accompaniment of childbirth. Blair Bell[7] notes lacerations in many cases of so-called normal labor. DeLee[8] is astonished at the amount of damage even normal labor causes, and amazed at the complicity of the injuries. Danforth[9] admits that nearly all, if not all, women who bear children suffer some injury to the cervix.

Most cervical lacerations become infected and produce a cervicitis with its consequent evils. They need only be mentioned here, leucorrhea, eversion, ectropion, erosion, hyperplasias of the epithelium and glands, cyst formation, etc. Thus, it is evident that following labor, a normal physiologic process, most women receive lacerations and attendant endocervicitis. Therefore, the occurrence of endocervicitis can almost be considered a usual event in childbearing women.

Peterson[2] has worked out the age distribution in his series of 406 cancers of the cervix. Most of the cases occur between the ages of thirty-five and forty-five, when pregnancy and labor have already taken place and have left their sequelae behind. O'Brien[10] remarks that at this age of life only 9.16 per cent of women have not been married. Kelly[11] noted that 98 per cent of his series of squamous cancers of the cervix had histories of previous childbirth. Cullen[12] in 50 cases of squamous-celled carcinoma of the cervix found that only one had not been through labor. It is pointed out by many writers that the number of pregnancies does not influence the occurrence of cancer of the cervix, but that the actual incident of a single labor is sufficient. Polak[13] quotes Graves's findings of 91 per cent incidence of obstetric trauma preceding 538 cases of cancer of the cervix. He contrasts these results with a study of the hospital records of 4,815 cervical repairs, which included the operations of trachelorrhaphy, amputation, and cauterization. It was found that only 7 of these patients later developed cancer, and in

3 of them malignant changes were already present in the tissue at the time of the primary operation.

Chronic endocervicitis is generally recognized as a great factor in the production of cancer. Cancer of the cervix was preceded by chronic endocervicitis in 34 out of 48 cases (Polese[14]). Polak[15] makes the statement that "long-continued cervical inflamamtion may be considered a prodrome of cervical cancer, for it is but a step from the extreme cell proliferation with an orderly arrangement that occurs in hyperplastic endocervicitis and cervicitis, to the disorderly arrangement of embryonal cells found in cancer." C. J. Miller[16] believes that "endocervicitis is a condition to which may be truly applied that much-abused word, precancerous." Warthin[17] upon examination of the cervix in several unmarried women who had previously received repeated traumas of this organ for a number of years through
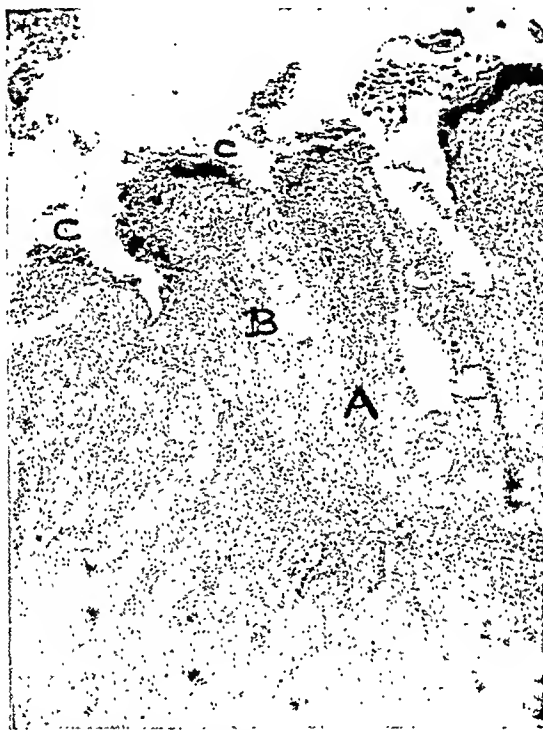

Fig. 2.—Cervix, patient aged sixty-eight. Erosion. Various stages of this condition are seen. As a result of severe inflammation, the stratified squamous lining of the portio has become macerated and is missing, C. The new columnar layer destined to cover the denuded subepithelial tissue temporarily has not developed as yet. A later stage of healing in which new squamous epithelium is overcoming the newly formed glands is seen at A and B.

treatment by medical men, found "all sorts of early precancerous conditions, inflammatory hyperplasias, atypical regenerations, and metaplasias, up to fully developed carcinomas."

Although chronic endocervicitis may be caused by other etiologic factors, it is accepted that the most frequent cause is the trauma and lacerations of labor with consequent infection. The other causes of infection are chiefly gonorrheal and those of pyogenic bacterial origin. Hess[18] regards gonorrheal vulvovaginitis in children as involving the cervix rather than the vagina. When one considers that the uterus from the fundus to the external os is germ-free (Barbour[19]), while the

vagina does harbor germs, it can readily be appreciated why the traumas of labor cause most pathologic conditions in the cervix. Endocervicitis is a very frequent condition, as 85 per cent of all women, single or married, have infected cervices (Polak[15]).

In our series, most of the patients examined had developed endocervicitis. These inflammatory cervices have been grouped, for purposes of study, under the following subdivisions: viz., A, erosion of the cervix; B, epidermidalization (metaplasia); C, hyperplasia of the squamous epithelium, and D, hyperplasia of the glands.

A. Erosion of the Cervix.—Exclusive of the congenital type the adult erosions, according to Adair,[20] occur very frequently during la-
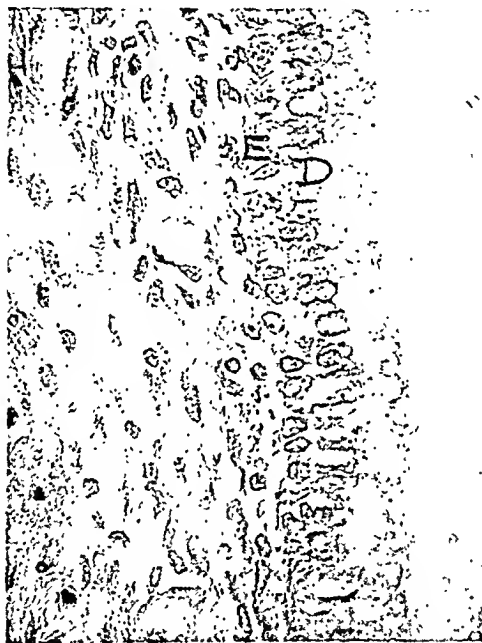

Fig. 3.—Cervix, patient aged thirty-nine. Illustrating the first step in the process of epidermidalization (metaplasia of columnar epithelium). High-power view. Between the original columnar cells, *D* and the basement membrane is noticed a new layer of polygonal cells, the infraepithelial cells, *E.*

bor. Out of 102 patients with normal labors, who were later examined by Kerwin,[21] he found 21 showing marked cervical erosions.

These erosions showed various stages, the first being the loss of the portio squamous epithelium, resulting from the inflammation, thus exposing the subepithelial tissue. Underneath is a true picture of inflammation with many new glands formed. In the second stage occurs the first attempt at healing, and the ulcerated area is covered with true columnar epithelium which can better withstand the effects of the discharge. Soon squamous epithelium grows in from the margins and in the third stage there is final healing, consisting of an overrun of squamous epithelium into the glands and underneath the columnar tissue undermining it. The glands may become filled com-

pletely with solid plugs of squamous epithelium or their openings may be blocked, producing cysts. Finally, the filled glands flatten out and merge with the squamous layer, and thus the ulcer is completely bridged over. (See Fig. 2.) Thus, the erosion is a curious and loose mixture of squamous and columnar epithelium.

Several authors hold that an erosion can become cancerous through overgrowth of the new squamous epithelium. Eden and Ley[22] conclude: "It will probably become in time established that it is the erosion which is accompanied by deep cervical lacerations, by thickening and eversion of the lips of the cervix, and histologically by abundant round-celled infiltrations, which is most liable to become

Fig. 4.—Cervix, patient aged twenty-nine. Later stage of epidermidalization. Increasing stratification at *C*, with differentiation into the flat desquamating type at *A*, Note how abruptly the normal columnar epithelium, *B*, joins the infraepithelial cell patches.

cancerous. The form which occurs in nulliparous women is probably more benign." Ewing has noted early cancerous overgrowth of the edges of a chronic erosion, and he believes cervical erosion to be the most definitely established lesion known to precede cervical cancer.[23] Rubin[24] discusses three cases of early cancer beginning in healing erosions. Stone[25] mentions several investigators who have the same views on the origin of portio cancers from erosions. Polak[26] holds that cervical erosion is a constant precursor of cancer.

B. Epidermidalization and Epidermoidalization (Metaplasia) of Columnar Epithelium and Glands.—By this is meant a change from the

single-layered columnar type of cervical epithelium into several layers of squamous tissue closely resembling that of the portio. Because of the doubt of origin of these new layers Fluhmann[27] discourages the use of the terms "metaplasia of cylindrical epithelium" or "stratification of cylindrical epithelium." He stresses the adoption of the description "epidermidalization" when the stratification is normal in appearance, and the term "epidermoidalization" when the layers are atypical. This terminology is accepted in this paper. These changes can take place either on the surface of the endocervix or in the glands proper. Cases where glands or stroma have been overcome by hyperplasia of the lining squamous epithelium

Fig. 5.—Cervix, patient aged forty. Epidermoidalization process. Excessive atypical overgrowth of new squamous cells along the walls of a large duct, penetrating into glands and overcoming them; and also dipping down into the stroma. At A and B a view is given of the beginning of the process, with new cells piling up under the columnar epithelium normally lining the duct. Further up at C is the increasing stratification in glands and stroma. These masses of cells consist of an outer rim of prickle cells with a central collection of flat desquamating cells. The unaffected duct lining is shown at D. Picture is suggestive of a carcinoid condition.

which has penetrated deeply are not included in this subdivision but are studied later under the heading of "hyperplasia of the squamous epithelium." It is possible, however, to have in the same section examples of the so-called metaplasias and squamous hyperplasias.

The stratification develops layer upon layer, although it is irregular in tempo of growth. Thus various stages of epidermidalization can be seen at one and the same time in the field examined. The most frequent appearance is that resembling a piling-up of the cells of the

lowest layer of squamous epithelium, the basal-celled layer. (See Figs. 3 and 4.)

In some cases the epidermidalization formation becomes greatly exaggerated. There results a remarkable proliferation of dense masses of squamous epithelium which are definitely atypical and suggestive of the "precancer" state. (See Fig. 5, which illustrates "epidermoidalization.")

If one accepts the view that epidermoidalization is a precancerous state, the milder cases of epidermidalization can be explained as the earliest stages in the development of potential squamous-celled carcinoma.

Fig. 6.—Cervix, patient aged forty-five. Squamous epithelium hyperplasia and downgrowth. Note the epidermized glands, A, the masses of ingrowing squamous epithelium, B, and the various unaffected columnar parts, C.

There is noticeable in these cases, both types, an inflammatory condition or cervicitis. This seems to be the exciting factor for the production of these new cells. Fluhmann[27] found cervicitis to be present in every case of epidermidalization he examined. In 1195 consecutive specimens of the cervix uteri he found 59 cases of epidermidalization in various stages of development. In this series of 124 specimens there were 15 cases of epidermidalization and epidermoidalization, all occurring in cervicitis.

Fluhmann[27] gives a very good summary of the various theories advanced for the genesis of the new layers of cells concerned in epidermidalization. According to Eichholz[28] and Frankl,[29] they originate from the basal cells of near-by squamous

epithelium. Against this theory is the occurrence of epidermidalization at the tips of polyps and deep in glands where no adjacent squamous epithelium is present. Robert Meyer[30] believes that congenital nests of squamous epithelium left underneath the columnar epithelium undergo new growth and substitute the cylindrical epithelium. Kaufmann[31] and Ocri[32] in 1906 concluded that there was a definite metaplasia of the cylindrical into squamous epithelium and that these infraepithelial cells were a transitional phase.

Eichholz[28] and Geller[33] also presume that certain embryonic undifferentiated cells can be included in cylindrical epithelium and possess the potentiality of developing into either type of tissue. Krompecher[34] believes that cylindrical epithelium possesses a basal-cell layer which is embryonic and can differentiate into squamous epithelium.

C. Hyperplasia of the Squamous Epithelium.—In this instance there is an increase in the cells of the various layers of the portio squamous

Fig. 7.—Cervix, patient aged thirty-three. Epidermization of gland through excessive downgrowth of surface squamous epithelium. At *A* there is marked proliferation of squamous cells into rupture through the basement membrane. The cells here are beginning to assume an abnormal appearance. The picture is that of a carcinoid change.

epithelium. As a result the undulating lower border of the epithelium becomes very irregular through downgrowth into the stroma. All stages of hyperplasia can be seen, from the simplest with small flat papillary downgrowths to the extensive showing extremely long pegs of squamous epithelium invading the deeper layers of the stroma and overcoming glands. It is these severer grades of hyperplasia that may possess some of the attributes of cancer, and are definitely labelled precancerous by many writers.

The squamous epithelium replaces the columnar epithelium of the surface or glands by direct extension and thus differs from the process

of epidermidalization previously described. Some of the sections, however, show the two conditions existing on the same slide. (See Figs. 6, 7 and 8.)

From these sections, it is not difficult to understand how the elongated pegs of squamous epithelium could infiltrate the stroma in the malignant fashion upon further irritation.

Several of the hyperplastic specimens examined exhibit a horny layer, which normally is absent. None of the sections show any pearl formation.

The condition of squamous epithelium hyperplasia and downgrowth seems to be a frequent one. Including mild cases of hyperplasia there
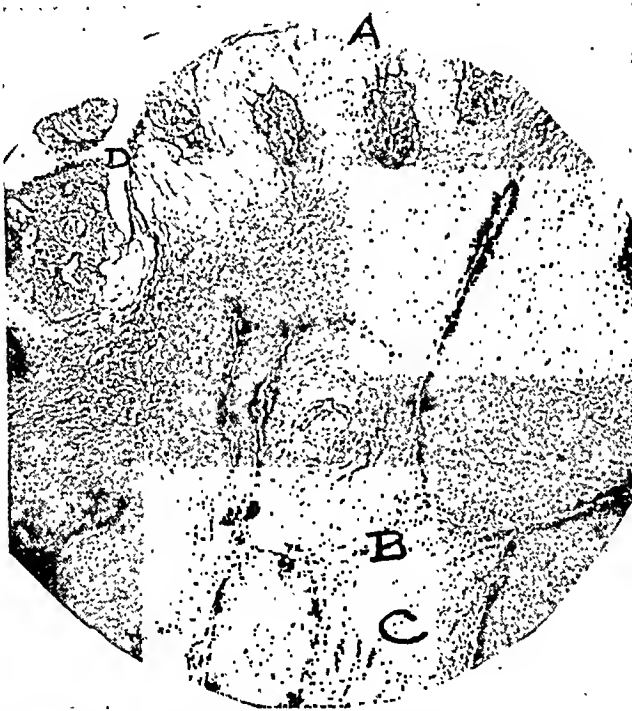

Fig. 8.—Cervix, patient aged thirty-four. Papilloma of the cervix. Illustrative of a leukoplakia condition. Extraordinary broadening of the squamous layers, the epithelium being about six times as broad as the normal lining. *A*, upper border of squamous epithelium; *B*, lower border; *C*, overshadowed stroma.

were found in this series of 124 cases, 29 such specimens. The etiologic factor at the base of these hyperplasias is cervicitis and this is very evident histologically.

White and Weidman[35] studied epidermal hyperplasia at the margins of cutaneous ulcers, and concluded that "every gradation of hyperplasia occurs among such ulcers, even to those which mimic early epithelioma perfectly as expressed histologically."

Itchikawa and Baum[36] painted rabbits' ears with tar and could trace the development of carcinoma in some animals from the marked hyperplasia and hyperkeratosis of the epithelial cells, especially the cells of the hair follicles. The hyperplastic areas developed into follicula-epitheliomas and then there was further progression into definite carcinomas.

Since about 97 to 98 per cent of all cervical carcinomas are of the squamous-celled type, the study of excessive squamous-celled hyperplasia looms up as of the greatest importance.

D. Hyperplasia of Glands.—Several of the inflammatory cervices are characterized on section by a hyperplasia of the glands. The glands increase in number and may either be collected into patches or lie discrete. The increase varies, and in some the proliferating glands may be so numerous and with little intervening stroma as to suggest the formation of adenoma. The lining of the glands is mainly high columnar, which, however, can be changed to a low flattened type when the glands become cystic and are filled with much secretion.

Fig. 9.—Cervix, patient aged thirty-four. Case of endocervicitis. Glandular hyperplasia simulating adenoma.

Many glands are noticed with papillomatous projections into the lumina. Occasionally an increase in number of lining layers may be noted. See Fig. 9. It shows one of several patches interspersed in the stroma. In this series there were 8 other such glandular hyperplasias, although they were lesser in degree.

Huggins[37] presents an illustration of this type in a polyp of the cervix and remarks that "the rather rare condition of adenocarcinoma occasionally starts in this type of growth." Stone's illustration[25] resembles Fig. 9, and he remarks: "There are glandular hyperplasias which lead to adenoma or adenocarcinoma." Adami and McCrae[38] recognize that there is a difference in degree only and not in kind between the inflammatory or irritative hyperplasia of glandular epithelium, the adenomas and finally the malignant glandular carcinomas.

Yeomans[39] discusses rectal adenomas. He believes that in their early stage there is a diffuse marked hypertrophy of the epithelial lining and quotes Ewing to that effect. He also mentions the view of Verse that irritation (bacterial, chemical, or mechanical) is a predisposing factor. He concludes, after remarking on the frequency of malignant changes of these adenomas: "Both clinically and by histologic study of the specimens, the transition from simple inflammatory hyperplasia to tumors pathologically cancerous can be traced through the stages of inflammation, gland cell hypertrophy and hyperplasia, and adenoma to definite adenocarcinoma. It is a logical inference that continuance of the irritative factors that induce the adenoma stimulate epithelial hyperplasia until it breaks through normal bounds and becomes malignant."

Senile Period.—This period includes the changes incident to "old age" and those due to sexual senility or the menopause. The cervix begins to atrophy and to undergo regressive and degenerative changes.

An interesting condition is seen in Fig. 10 (autopsy specimen, age fifty-three). In this case the cervix is undergoing senile degeneration
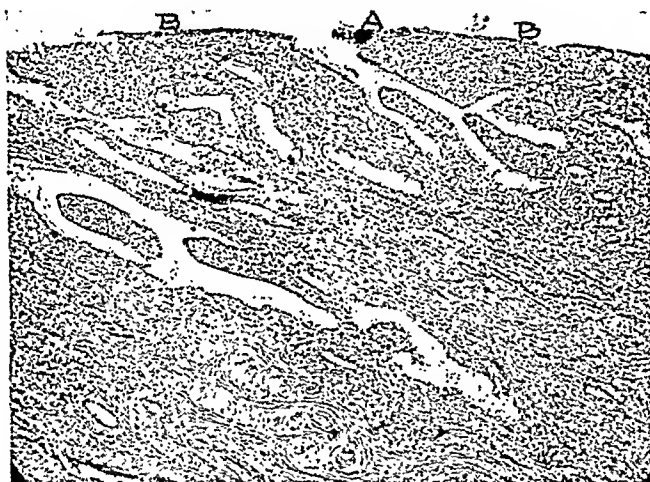

Fig. 10.—Cervix, patient aged fifty-three. Senile involution hyperplasia. In a field of senile degeneration is noticed a new hyperplastic condition of epidermization and gland formation. Note at A the new polygonal cells which are growing on the senile flat cuboidal lining, B. The newly formed glands are very evident. Some spots in the duct walls are still untouched by senility changes.

and the process is greatly varied in different parts. There is a marked hyperplasia of glands which is unusual for this age period. At one spot "A" the senile cuboidal lining layer merges with a patch of epidermization consisting of polygonal cells; in other words, there is a new formation of hyperplasia on the site of a senile degeneration.

Regressive hyperplasias are known to precede cancer, especially in the breast and prostate of seniles. According to Ewing[1] the chief condition predisposing to prostate cancer is chronic prostatitis, usually with hypertrophy. He makes the statement: "Whatever the nature of prostatic hypertrophy may be, it is clear that the influence of physiologic involution is concerned." He quotes other authorities who hold that 13.3 to 16.5 per cent of enlarged prostates after fifty years of age become malignant.

The skin in senile degeneration may show signs of old age and then be followed by marked hyperplasia which may proceed into the carcinomatous stage. Oertel[40] in routine examination of normal involuting breasts and prostates notes the frequent occurrence of carcinoid changes (potentially cancerous) and illustrates the growth of the proliferative atypical cells into duct lumina of these organs, and also to the outside of the duct wall. He describes the potentially malignant cells as follows: "These cells change their morphologic and tinctorial characters, assume appearances of altered differentiation with atypical shape and size and develop disturbed nuclear-plasma relations. Such abnormal cell types are also seen to undergo excessive hyperplasia." He finds these cell changes "not only in connection with general and otherwise typical glandular hyperplasia, but also in areas of gland reduction and collapse."

DISCUSSION

One is struck by the ready interchangeability between the two epithelia of the cervix throughout the different age periods. This occurs developmentally, physiologically, and pathologically. Far more frequent is the change of columnar into squamous epithelium, as has been sufficiently illustrated. The erosions, perhaps, give an example of the transformation of squamous epithelium of the portio to that of the columnar type.

Several writers have attested to the occurrence of metaplasias of the cylindrical epithelium of the endometrium. These have been shown to occur in menstruation, pregnancy, and after the menopause (Klein,[41] Mueller,[42] Moericke[43]). Hitschmann's[44] theory for this metaplastic occurrence in the endometrial epithelium is that the uterine mucosa retains the old embryologic characteristics of the müllerian ducts and has the power to transform into either type of epithelium. If one accepts this view, the cervix would naturally also possess this potentiality of epithelial differentiation.

Ontogenetically stratified squamous epithelium and cylindrical epithelium are closely related and both possess the natural ability to cover up exposed surfaces, although in the cervix the squamous epithelium is much more active in this respect. Squamous epithelium has greater powers of resistance than cylindrical, and this would explain the marked growth of the squamous layers in the erosions and in the so-called "metaplasias" of columnar epithelium. The stratification is laid down as a protection against the chronic irritant but unfortunately in many cases has the tendency to overstep bounds and to develop along atypical tendencies.

It would appear that there is a loss of balance between the two lining tissues of the cervix, as if the two epithelia were antagonistic and in opposition to one another. They are restrained, but there is a stronger tendency for the squamous cells to overrun the picture.

As shown above, even in the normal there is no fixed union of the two epithelia at the external os, but one can overstep into the other. This imbalance is greatly exaggerated following injury and inflammation, especially after labor, when in addition there is a strong inclination for the hyperplastic squamous epithelium to grow downward in the stroma. In other words, the cervix is a restless tissue and exceptionally liable to take on atypical growth due to the possession of two easily interchangeable epithelia.

Although none of the sections in this series can be classified as cancerous, yet a fair number are labelled "precancerous." There is much uncertainty as regards the meaning of this ill-used word. This is because of the lack of definite criteria that are characteristic histologically of this condition, and the fact that not all precancerous lesions go on to definite cancer. Because of this doubt the personal factor enters very largely in the matter of diagnosis of future cancer of the cervix from section examination, although clinically it is well recognized that there is a precancer stage.

Schauenstein,[45] Schottlander,[46] Ewing,[1] and Rubin[24] describe as characteristic of incipient carcinoma the following:

1. Irregular arrangement of cells.
2. Loss of cell boundary.
3. Abnormally close juxtaposition of cells.
4. Changes in chomatin network.
5. Changes in protoplasm toward stains (eosinophilia).

Findley[47] agrees with Ewing[1] who concludes that "when atypical hypertrophic and hyperchromatic cells are growing downward from the epidermis or fill enlarged gland alveoli the diagnosis of beginning carcinoma is justified." Frank[5] doubts the possibility of diagnosing early cancer in "conditions which, lacking as we do absolute histologic criteria of early malignancy, may as well prove to be harmless epithelial proliferation." He believes that a carcinoma is unmistakable, and insists that "while a specimen may be suspicious, in a given case we are dealing either with a cancer or not." He quotes Lubarsch as saying that cancer should be diagnosticated only "when one has found sure and clear criteria of destructive growth." Frank doubts Ewing's belief that we may be dealing with a condition "in the process of becoming cancer."

Healy[48] does not find the gross appearance of early carcinoma of the cervix typical and admits the difficulty of distinguishing chronic cystic and interstitial cervicitis with erosion from moderately developed or early infiltrating epidermoid carcinoma with ulceration. The weight of opinion, however, seems definitely to establish the conviction that there is an earlier predisposing phase of cancer, the precancer stage.

As previously mentioned, not all precancers turn into genuine cancers later. Various writers (Fluhmann,[27] L'Esperance,[49] Stone,[25] etc.) who believe in the evolutionary possibilities of development of cancer from the precancer stage, doubt whether all such precancers turn into malignancy. Some of the artificially produced tar cancers in animals do not develop into genuine cancers, although possessing a cancerous picture histologically. Borst suggests the term "carcinoid" rather than "precancerous," which ordinarily presumes a cancerous termination. In other words a carcinoid condition is potentially able to develop cancer, but does not necessarily do so.

Gynecologists are very much impressed with the frequency and virulence of cervical cancer and stress the necessity of early diagnosis. The majority believe in histologic examination of any suspicious tissue. Meyer and Kaufman[50] made biopsies of the portio in 146 cases, and found cancer in 26. In only 15 of this group had the clinical diagnosis been made. In 2 cases of this series the microscopic examination revealed cancer when it was not even suspected.

Immediate examination and repair of the large number of cervical lacerations occurring at labor is now urged. Some advise postpartum examinations with subsequent early repairs. The profession is being constantly advised on the signs of early cancer of the cervix. L'Esperance[49] suggests "systematic vaginal examination of women in the cancer zone, especially those who have borne children." All should view the cervix in the same light as Charlton[51] who aptly writes: "Let every chronically infected cervix be approached, not as a cervical catarrh, not as an hypertrophy, not as a laceration, but as the prologue of an epithelial drama whose curtain may be malignant death."

CONCLUSIONS

Microscopic examination has been made of 124 cervices, mostly cases of cervicitis (24 autopsy and 100 surgical). The following conclusions are presented:

1. The cervix is a restless organ with its tissue components continually in a state of imbalance.

2. There is a remarkable facility of interchangeability of the two lining epithelial types at all age periods.

3. From the very beginning, during the fetal period, there is no fixed union of the two epithelia at the external os but one can overstep into the other.

4. At labor the cervix is especially prone to develop an endocervicitis, due to the production of cervical lacerations.

5. Because of the restlessness of the cervical epithelia, endocervicitis is of great significance due to the metaplasias of the columnar lining and excessive downgrowth and thickening of the squamous epithelium which follow.

6. Many of the results of endocervicitis represent a precancerous stage, which need not necessarily go on to true cancer development. For these the term "carcinoid," suggested by Borst, is preferable.

7. In senility the regressive hyperplasias have to be considered in the light of a precancerous, or better, a dysontogenetic condition.

8. In the prophylaxis of cancer of the cervix, cervical lacerations should be quickly repaired. The local histologic examination in suspicious cases should be augmented by the clinical records. Surgery is

to be followed if the precancerous stage is greatly aggravated and true cancer seems imminent.

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REFERENCES

(1) *Ewing:* Neoplastic Diseases, ed. 2, 1922, W. B. Saunders Co., Philadelphia, p. 543. (2) *Peterson, R.:* Surg. Gynec. & Obst. 29: 544, 1919. (3) *Anspach:* Gynecology, ed. 3, 1927, J. B. Lippincott Co., New York. (4) *Fischel, W.:* Arch. f. Gynäk. 15: 76, 1897. (5) *Frank, R. T.:* Gynec. & Obst. Pathology, 1922, D. Appleton & Co., New York. (6) *Williams, J. W.:* Obstetrics, ed. 4, 1917, D. Appleton & Co., New York. (7) *Bell, Blair:* The Principles of Gynecology, ed. 3, 1919, Wm. Wood & Co., New York. (8) *DeLee, J. B.:* AM. J. OBST. & GYNEC. 14: 499, 1927. (9) *Danforth, W. C.:* AM. J. OBST. & GYNEC. 15: 505, 1928. (10) *O'Brien, W. A.:* J. of Cancer Research 9: 391, Sept., 1925. (11) *Kelly, H. A.:* Medical Gynecology, ed. 2, 1913. (12) *Cullen:* Cancer of the Uterus, 1900, D. Appleton & Co., New York. (13) *Polak, J. O.:* AM. J. OBST. & GYNEC. 15: 295, March, 1928. (14) *Polese:* Centralbl. f. Gynäk. p. 284, 1906. (15) *Polak, J. O.:* Pelvic Inflammation in Women, 1922, D. Appleton & Co., New York. (16) *Miller, C. J.:* Surg., Gynec. & Obst. 46: 337, 1928. (17) *Warthin:* J. Cancer Research 9: 494, 1925. (18) *Hess:* Quoted in Polak's Pelvic Inflammation in Women, 1922, D. Appleton & Co., New York. (19) *Barbour:* Albutt, Playfair & Eden, A System of Gynecology, pp. 237, 248, 1909. (20) *Adair, F. L.:* Surg., Obst. & Gynec. 10: 337, 1910. (21) *Kerwin, W.:* AM. J. OBST. & GYNEC. 6: 185, 1923. (22) *Eden, T. W., and Ley, G.:* AM. J. OBST. & GYNEC. 1: 11, 1920. (23) *Ewing:* Med. Record, Dec. 5, 1914. (24) *Rubin:* Am. J. Obst. 62: 668, 1910. (25) *Stone, W. S.:* Surg., Obst. & Gynec. 23: 248, 1916. (26) *Polak, J. O.:* AM. J. OBST. & GYNEC. 15: 29, 1928. (27) *Fluhmann, C. F.:* Ibid. 15: 1, 1928. (28) *Eichholz, P.:* Inaug.-Diss., Konigsberg, April 10, 1902. (29) *Frankl, O.:* Liepman's Handbuch der Frauenheilkunde, Leipzig, F. C. W. Vogel 2: 445, 1914. (30) *Meyer, R.:* Arch. f. Gynäk. 91: 579, 1910. (31) *Kaufmann, E.:* Cor-Bl. f. schweiz. Aertzte 36: 227, 1906. (32) *Oeri, R.:* Ztschr. f. Geburtsh. u. Gynäk. 62: 384, 1906. (33) *Geller, Fr.:* Chr. Zentralbl. f. Gynäk. 47: 406, 1923. (34) *Krompecher, E.:* Beitr. z. path. Anat. u. z. allg. Path. 72: 163, 1923-24. (35) *White and Weidman:* J. A. M. A. 88: 1959, 1927. (36) *Itchikawa and Baum:* J. Cancer Research 9: 85-104, March, 1925. (37) *Huggins, R. R.:* AM. J. OBST. & GYNEC. 4: 552, 1922. (38) *Adami and McCrae:* Text-Book of Pathology, ed. 2, 1914, Lea & Febiger, Philadelphia. (39) *Yeomans, F. C.:* J. A. M. A. 89: 852, 1927. (40) *Oertel, H.:* Canad. M. A. J. 16: 237, 1926. (41) *Klein:* Munchen. med. Wchnschr. 23: 616, 1897. (42) *Mueller:* Samml. Klin. Vort. Leipzig, p. 413, 1906. (43) *Moericke:* Ztschr. f. Geburtsh. u. Gynäk. 7: p. 84. (44) *Hitschmann:* Arch. f. Gynäk. 69: p. 629. (45) *Schauenstein:* Arch. f. Gynäk. 85: 576, 1908. (46) *Schottlander:* Gynäk. Rundsch., p. 509, 1912. (47) *Findley, P.:* AM. J. OBST. & GYNEC. 11: 450, April, 1926. (48) *Healy, W. P.:* AM. J. OBST. & GYNEC. 15: 353, March, 1928. (49) *L'Esperance, E. S.:* Idem. 8: 461, October, 1924. (50) *Meyer and Kaufman:* Zentralbl. f. Gynäk. 1: 20, 1926. (51) *Charlton:* AM. J. OBST. & GYNEC. 13: p. 755.

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ETIOLOGIC FACTORS IN CARCINOMA OF THE CERVIX[1]

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DURING the last few years a great deal of information has been published concerning the structural classification, pathologic and clinical behavior, and the treatment of carcinoma of the cervix, by prominent clinicians,[1, 2, 3, 4, 5] but, with relatively few exceptions, the etiology of the disease has been carefully avoided.

Cullen[6] reviewed the various conspicuous theories of malignancy (heredity, trauma, Cohnheim's cell inclusion, Ribbert, Virchow, parasitic) and finally agreed with Hannseman and Hauser that cancer is primarily a disease of the epithelium, but emphasized our ignorance of the causes of cell alteration. Such authorities as Bloodgood,[8] Mallory,[9] Councilman[10] and Schiller[11] have agreed as to the uncertainty of the origin of cancer. Ewing[7] suggests that there are different factors in the different types of malignancy found in various anatomic locations.

Many writers have noted cancer of the cervix to be a disease of the poor and ill-nourished classes. Theilhaber believes that cancer develops in poorly nourished organs and cites as a factor that the menstrual life of the poorer classes averages five to six years less than that of better constituted women.

Frazer[22] points out as factors in the causation of cancer: Chronic Irritation, coupled with a Predisposition to the disease. Loeb[23] and Slye[24] believe that any, inherited resistance to the development of cancer can be overwhelmed by a chronic irritant of sufficient strength.

Bailey[25] suggests as a basic cause of cancer of the cervix that there are many initial causal factors concerned in the production of an intermediate causal factor which is constant. This intermediate causal factor is the inflammatory exudate in contact with the epithelium.

Shaw[26] states that there is no specific substance which alone is cancerogenic; the specificity lies in the physicochemical complex of viscosity, insolubility in the tissue fluids, and toxicity.

Stone,[12] Graves,[13] Healy[14] and others have pointed out as a factor, the trauma of parturition with its resulting laceration of the cervix, ectropion and erosions. In the statistics of Healy,[14] Farrar,[15] Leipman, Kolblouch and Theilhaber, in whose series nulliparae represent only 2.5, 4.0, 1.77, 4.6, and 2.9 per cent respectively and the number of patients with pregnancies varied between 92 per cent and 98 per cent, this factor is shown to be relatively constant.

However, since many women of the poorer classes, having multiple pregnancies, do not develop cancer of the cervix, other factors must be involved. Howitz,[17] in reviewing cervix cases at The Mayo Clinic, has reported that in spite of their noted fertility and longevity, the disease was only one-fourth as frequent in Jewesses as in Gentile women. L'Esperance[20] has suggested the possibility of the failure of younger Jewish women to observe the Mosaic Laws as a factor in the increasing

evidence of cancer of the cervix among Jewish women, and work is now being done by her from this angle. Reel[16] and many others have stated the necessity of cleaning up erosions and low-grade infections as prophylaxis against cervical cancer. Smith, Smithwick and Rogers[18] in 1928 reported that of 550 cases of cancer of the cervix only 2 had had trachelectomies performed and not one had been treated with the cautery. Also of 1150 cervicitis cases treated with a cautery between the years 1914 and 1923, not one had developed cancer of the cervix at the time of this publication. Surely, then, there must be other factors than the lacerated cervix and associated ectropion of mucosa, as induced by the trauma of parturition. Adair[19] suggests that one must look for chemical and bacterial, as well as mechanical, factors.

With these factors in mind, a series of cases of known carcinoma of the cervix has been compared with a practically equal number of patients who have escaped the disease, in the attempt to discover wherein the two series differ and with the hope of finding possible etiologic factors.

Because of the constant high percentage of women who have had pregnancies, in all the reported cervical cancer series, only patients that had had two or more pregnancies and had reached the age of cancer incidence have been selected for the control group. Knowing cancer of the cervix to be a disease of the poor, all of the control group were selected from patients in the clinics and wards of Memorial and other hospitals. The statistics were obtained by personally interviewing each of the 226 cancer patients and the 202 patients of the control group. The cancer patients were taken from the Gynecological Service of Memorial Hospital.

TABLE I. CLASSIFICATION OF CANCER SERIES AS TO MARRIAGE AND PREGNANCIES

	NUMBER	PER CENT OF TOTAL
Total number of cases	226	100.0
Married	222	98.2
Single	4	1.8
Married but no pregnancies	12	5.3
Pregnancies	210	92.8

This shows the classification of the cancer series with the low percentage (1.8 per cent) of nulliparous women and the high percentage (92.8 per cent) of women having pregnancies as a constant factor in the selection of control patients.

TABLE II. CLASSIFICATION OF CONTROL CASES

LESIONS	NUMBER
Breast	58
Fibroids	54
Pregnancy	52
Stomach	3
Ovarian	6
Vulva	3
Senile vaginitis	6
Endometritis menopause	19
Lymphosarcoma skin	1
Total	202

This is the classification as to diagnosis of the control patients. It is to be noted as a possible weakness in the selection of controls that 52 were maternity patients in wards of New York Lying-In Hospital; a weakness because practically no time elapsed between the last delivery and the time of interviewing the patient, hence, theoretically, not time for cancer to develop. However, all of these 52 cases were between thirty-six and forty-six years of age (37 being under forty years, 15 over forty years) and had had more than two children, and eight years or more had elapsed since their first delivery.

TABLE III.   COMPARISON OF TWO SERIES AS TO NATIONALITY

	CARCINOMA		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Black	20	8.8	31	15.3
White	206	91.1	171	84.6
German	20	8.8	17	8.4
Italian	74	32.7	30	14.8
Jewish	15	6.6	33	16.3
Greek	2	0.8	0	0.
Irish	45	19.4	52	25.7
Polish	8	3.5	3	1.4
Others	42	18.5	36	17.8
Total cases	226		202	

The comparison of the two series as to nationality is of interest because it shows Italians to make up about a third of the cancer group. While cancer of the cervix is known to be prevalent among Italians, their relatively large proportion in this series may be misleading because of Memorial Hospital's large Italian clientele.

TABLE IV.   COMPARISON OF CANCER AND CONTROL SERIES AS TO AVERAGE AGE, NUMBER OF PREGNANCIES, AND TIME SINCE LAST PREGNANCY

	CARCINOMA		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Total	226		202	
	210 (Preg.)			
Average age	46.0 yr.		44.2 yr.	
Youngest	26 yr.		36 yr.	
Oldest	66 yr.		69 yr.	
Under 40 years	50	22.1	52	25.7
Average number pregnancies	3.9		3.4	
Average time since last pregnancy	17.5 yr.		16.5 yr.	
Last pregnancy within five years	17	8	52	25.7
Last pregnancy within ten years	53	20.4	57	28.4

While the average age of the control group at the time interviewed is forty-four and two-tenths years as opposed to forty-six years for the cancer group (Pack's[21] average age for all cases of cancer of the cervix at Memorial Hospital is forty-eight years), the range of ages was higher in the control group and excluding the 52 maternity patients, the average age of the remaining controls was forty-seven and two-tenths years. The number of patients under forty years of

age and the average number of pregnancies for each patient shows a favorable comparison in the two groups. The average time since the last pregnancy is about equal including all cases. Excluding the 52 maternity cases this average time for the remaining control patients is twenty-three years. The only control patients having the last pregnancy within five years were the 52 maternity patients. Only 5 of the remainder of the controls had their last pregnancy within ten years, giving a total of 57 patients which compared satisfactorily with the cancer group.

Thus it would seem that the selection of these patients as a comparison group is justified.

TABLE V. COMPARISON OF TYPES OF MENSTRUATION

MENSTRUATION	CARCINOMA		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Age of onset (average)	13.7 yr.		14 yr.	
Average duration	4.7 days		4.8 days	
Irregularity	28	12.3	32	15.8
Dysmenorrhea	130	57.5	81	40.1
Dysmenorrhea after marriage	12	5.3	9	4.3

This is a comparison of types of menstruation. There is practically no marked variation between the two series. The group having dysmenorrhea at any time show the only noticeable difference and because of the difficulty of discounting the individual varieties of each patient's estimation of her dysmenorrhea this slight difference is discarded in concluding that menstruation is not a factor in carcinoma of the cervix. The time since menopause has not been considered, as a great many of the carcinoma group had not appreciated any onset of menopause. This is possibly a field for further investigation.

TABLE VI. COMPARISON AS TO PREGNANCIES, MARRIAGE AGE, AND INTERVAL BETWEEN MARRIAGE AND CHILD BIRTH

	CARCINOMA		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Average number of pregnancies	3.9		3.4	
One pregnancy only	40	19.0	0	0
Three or more pregnancies	138	65.7	131	64.8
Miscarriages	43	20.4	29	14.3
Average marriage age	20 yr.		21.4 yr.	
Average time before first baby	2.4 yr.		1.4 yr.	
First baby within one year after marriage	6	2.3	97	48.0
First baby within two years after marriage	70	33.3	175	86.6
First baby after two years	140	66.6	27	13.3

The average number of pregnancies and the average number of patients having three or more pregnancies show a practical equality. Of course, there were no patients, having one pregnancy only, in the control group. The number of patients having miscarriages seems

surprisingly small in both groups, but were the figures obtained. No information was sought as to percentages of induced abortions. This would possibly be of interest for its bearing on instrumentation of the cervix. The average marriage age was slightly higher for the controls. The average time between marriage and the first delivery shows a significant difference (two and four-tenths years for the cancer group as against one and four-tenths for the control). This leads to further speculation as to the use of contraceptives in spite of the belief that birth control is not practiced among the poor. Especially is it of importance when we consider that 66.6 per cent of the cancer group had their first delivery more than two years after marriage, as opposed to only 13.3 per cent for the controls. This is taken as the first possible factor in carcinoma of the cervix.

TABLE VII

TYPE DOUCHE	CARCINOMA		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Lysol	103	49.1	37	18.1
No douche	41	19.5	58	28.7
Salt	20	9.9	18	8.9
Boric	18	8.5	27	13.4
Water	15	7.1	49	24.2
Soda bicarb.	8	3.8	7	3.4
Peroxide	1		0	
Alum	2	less	2 .	less
Potas. permang.	2	than	2	than
Luko	0	1%	1	1%
Mucol	0		1	

It is of some interest to note that only two-thirds as many cancer patients as controls used no douches at all. No attempt has been made to determine the frequency of douching nor the strength of the solution used. All types of douches taken are those used before the onset of symptoms.

Striking is the increase in the number of cancer patients using Lysol douches over those of the control group. Lysol is a saponified product of coal-tar containing cresol, which in turn comes from beech-tar by distillation. Since 1914, when Yamagiwa[27] and Itchikawa succeeded in producing papillomas in rabbits' ears by repeated applications of tar, we have found the tars and oils in universal employment in the experimental production of cancer. Woglom[28] quotes industrial evidence that creosote oil produces cancer. De Jong,[29] Meyer and Martineau report squamous carcinoma developing on an eczematous area which had been painted daily for several years with coal-tar to allay the itching. As eczema is not known to be followed by cancer, they believed it reasonable to blame the tar for the production of the cancer. On the sole basis of the comparison between the cancer patients and controls, the use of Lysol douches is taken as the second possible etiologic factor in carcinoma of the cervix.

There was a moderate increase for the cancer group over the controls in the number of patients having one or more instrumental deliveries, but in this age of so-called prophylactic forceps in primiparae, this difference can hardly be given much weight. Those patients having, however, more than one instrumental delivery show that there were nearly five times as many in the cancer as in the control group. This is taken as the third possible factor.

TABLE VIII.   COMPARISON OF CANCER AND CONTROL GROUP AS TO INSTRUMENTAL DELIVERIES, DRY LABORS, CERVICITIS, AND TREATMENT

	CARCINOMA		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
Instrumental delivery	63	30	48	23.7
More than 1 instrumental delivery	21	10	5	2.4
Dry labors	128	60.9	41	20.3
More than 1 dry labor	44	20.9	9	4.4
Both instrumental and dry labor	39	18.5	8	3.9
Leucorrhea	59	28	81	40
Cases receiving any treatment	3	1.4	63	32
Per cent cases entitled that received treatment		5		77.7
Trachelectomy	3		5	
Cautery	0		18	
Clinic or doctor	0		40	

TABLE IX.   ETIOLOGICAL FACTORS IN CARCINOMA OF CERVIX

1. First baby more than 2 years after marriage.
2. Use of lysol douches.
3. More than one instrumental delivery.
4. Dry labor.
5. Untreated cervical lesion as manifested by leucorrhea.

	CARCINOMA		CONTROL	
	NUMBER	PER CENT	NUMBER	PER CENT
All factors present	3	1.3	0	0
4 factors present	8	3.5	0	0
3 factors present	45	19.5	4	1.9
2 factors present	105	46.4	23	11.3
1 factor present	42	18.6	41	20.7
Cases with one or more	203	89.8	68	33.6
No factors present	23	10.1	134	66.2
2 or more factors present	161	71.2	27	13.3

Dry labors show an astounding difference (60.9 per cent for the cancer group to only 20.3 per cent for the control). This is accentuated by 20.9 per cent of the cancer group having more than one dry labor as against only 4.4 per cent of the controls. Therefore, dry labor is taken as the fourth possible factor.

Leucorrhea, taken as the indication of cervicitis, erosion and probably laceration, occurred in more controls (40 per cent) than in patients of the cancer group (28 per cent). This might mean that the cancer group were too careless of body hygiene to recognize the leucorrhea, though the fact that more cancer patients than controls used douches would seem to dispute this supposition. It is of great

significance, however, that of patients requiring treatment for leucorrhea, 77.7 per cent of the controls received it as opposed to only 5.0 per cent of the cancer group. Therefore, untreated cervical lesions as manifested by leucorrhea is taken as the fifth possible factor.

It is of interest that the control and cancer groups are about equal in the number of patients having present any one of these possible factors only, but with the increase of the number of these factors present, the inequality in percentage comparison progressively increases. Of the 23 cancer patients having no factor present the 4 single women and the 12 married but never pregnant women should be further discounted because these 16 women could be considered as being exposed to only two of these factors (i.e., lysol douches and untreated cervical lesions) although the first factor must be considered with the 12 married patients. Eleven of the 23 cancer patients with none of these factors present are of the group of 16 that have had no pregnancies.

CONCLUSIONS

1. Parturition with its resulting damage to the cervix is a generally accepted etiologic factor in cancer of the cervix. With the majority of cancer patients proving to be multiparous, this factor increases in importance with the number of pregnancies.

2. The incidence of the disease is known to be higher in the poorer classes.

3. By comparison of a series of cancer patients with a control series with the two known factors constant in each series, there are apparently five additional possible factors.

   a. Length of time between marriage and first delivery (more than two years being selected for these statistics) with the suggestion of a possible field for investigation as to contraceptives used.
   b. Use of lysol douches.
   c. More than one instrumental delivery.
   d. Dry labor.
   e. Untreated cervical lesions as manifested by leucorrhea.

4. One of these five possible factors only was not present more often in cancer patients than in the control group but, with the incidence of two or more of the factors present, the inequality in percentages of each group total progressively increased with the increase in number of factors. It can certainly be considered that when two or more of these additional factors are present with the known factors of parturition and poverty, the incidence of cancer of the cervix is increased.

5. Menstruation is not shown to be a factor in carcinoma of the cervix.

6. Possible factors suggested as fields for further investigation are:

   a. Incidence of induced abortions with special reference to instrumentation.

   b. Contraceptives: types and duration of use.

   c. Duration of labor.

   d. Frequency of intercourse.

   e. Observance of Mosaic Laws.

REFERENCES

(1) *Ward, G. G., and Farrar, L. K.*: J. A. M. A. 85: 19, 1925. (2) *Ward, G. G., and Farrar, L. K.*: J. A. M. A. 91: 296-300, 1928. (3) *Healy, W. P., and Cutler, M.*: Am. J. Obst. & Gynec. 16: 15-28, 1928. (4) *Flubmann, C. F.*: Am. J. Obst. & Gynec. 13: 174-184, 1927. (5) *Farrar, Lillian K.*: Am. J. Obst. & Gynec. 10: 205, 1925. (6) *Cullen, T. S.*: Cancer of the Uterus, 1909, W. B. Saunders Co., pp. 651 and 174. (7) *Ewing, James:* Neoplastic Diseases, 1919, W. B. Saunders Co., p. 458. (8) *Bloodgood, J. C.*: N. Y. State J. Med. 30: No. 5, 225-259. (9) *Mallory, F. B.*: Principles of Pathologic Histology, 1923, W. B. Saunders, p. 251. (10) *Councilman, W. T.*: Boston M. & S. J. 132: 256 and 282, 1895. (11) *Schiller, W.*: Virchow's Arch. Path. Anat. 263: 279-367, 1927. (12) *Stone, W. S.*: Surg. Gynec. Obst. p. 248-261, Sept., 1916. (13) *Graves, W. B.*: Gynecology, 1919, W. B. Saunders Co., p. 334. (14) *Healy, W. P.*: Am. J. Obst. & Gynec. 10: No. 6, Dec., 1925. (15) *Farrar, L. K. P.*: Surg. Gynec. Obst. 43: 719, 1925. (16) *Reel, P. J.*: Am. J. Obst. & Gynec. 10: 94, 1925. (17) *Horwitz, A.*: Surg. Gynec. Obst. 44: 355-358, 1927. (18) *Smith, G. V., Smithwick, R. H., and Rogers, H., Jr.*: Am. J. Obst. & Gynec. 15: 637-650, 1928. (19) *Adair, F. E.:* N. Y. State J. Med. 30: No. 5, p. 270-274. (20) *L'Esperance, E.*: Personal Communication. (21) *Pack, G.*: Personal Communication. (22) *Frazer, Alex:* Pan American Med. Assn., May, 1930. (23) *Loeb, L.*: J. Cancer Research 8: 274, 1924. (24) *Slye, M.*: Radiology 4: 7, 1925. (25) *Bailey, K. V.*: Surg. Gynec. Obst. 50: 688, 1930. (26) *Shaw, J. J.*: The Cancer Process, Edinburgh, 1930, E. & S. Livingstone, p. 16. (27) *Yamagiwa, K., and Itchikawa, K.*: Verhandl d. japanish path. Gesellsch. IVte Tagung, 1914. (28) *Woglom, W. H.*: Experimental Tar Cancer, Institute of Cancer Research of Columbia University. (29) *DeJong, S. T., Meyer, J., and Martineau, J.*: Bull. de L'Assn. franç p l'etude du cancer 13: 326, 1924.

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Polzl, A.: **Use of Irradiated Fat in Gynecology.** Wien. klin. Wchnschr. 42: 272, 1930.

Results with Ried's irradiated salve (Metuvitsalbe) in infectious skin conditions led the author to investigate the effects of irradiated fat in gynecologic conditions. Masses of irradiated fat in the form of globules and bougies for vaginal use were produced. In 26 cases of vaginitis in patients of all ages, discharge and burning disappeared in two to three weeks. Erosions of the cervix healed, but in cases of adnexal disease there was no effect. Symptomatically the patients improved, especially where there was annoying discharge.

FRANK SPIELMAN.

NEPHRITIS IN PREGNANCY

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NEPHRITIS in pregnancy, although not a frequent complicating occurrence, is a very serious one. During pregnancy the renal burden, as well as that of the heart,[1] is increased and the whole body economy is disturbed. Impaired renal efficiency becomes inadequate more easily in pregnancy because of this increased burden. The neurovascular system shows evidence of increased instability,[2] the fat, carbohydrate, and protein metabolism is altered and the whole endocrine system is disturbed. A mild acidosis occurs in normal pregnancy, particularly during the last weeks.[3, 4] Anemia is frequently notable and at times is severe.[5, 6] All these factors adversely affect the processes of renal repair and rehabilitation during pregnancy and probably contribute in an indirect fashion to the etiology of such renal disturbances.

Renal disease in pregnancy is of several types. The classification of these types is essential for a proper conception of the problems of etiology, pathogenesis, symptomatology, therapy, and prognosis. A pathologic classification is both difficult and unsatisfactory. An etiologic classification is at present impossible, as the exact etiology of these vascular and renal disturbances is still shrouded in doubt. They all represent tissue reactions to an intoxication, but the source of this intoxication is uncertain. Separation of the acute and chronic cases of nephritis in pregnancy into two groups aids in establishing the prognosis.[7] The suddenness of onset is one of several criteria of the nature of the causative intoxication. Much confusion exists regarding the best means of classifying the renal injury, especially regarding the use of the terms nephritis and nephrosis.[8, 9, 10, 11, 12] These terms we shall carefully avoid, as their present status and meaning are interpreted too variously. To include renal injury in pregnancy under the heading of "toxemias of pregnancy" is grossly inaccurate; the intoxication in renal disease here as elsewhere affects the tissues primarily and often alters the blood but little. There is almost no conclusive evidence that the intoxication is one of the blood, as implied by the term "toxemia."

A recently popular term in the classification of renal injury in pregnancy is "low reserve kidney."[13] As used, the meaning of this phrase is grossly perverted[12] to mean a mild late intoxication in pregnancy with only slight arterial hypertension, moderate albuminuria, and

prompt recovery. An actually reduced renal reserve resulting from previous renal disease manifests itself far earlier in pregnancy and is associated with persistent and often excessive hypertension which is aggravated and often permanently increased by the intoxication and increased burden of the pregnancy. What has been called the "low reserve kidney" is better named the "syndrome of tissue and renal fatigue in pregnancy."

A clinical view of the types of hypertension and nephritis as occurring in pregnant women permits of their classification into four groups.[14] These groups may be listed, for convenience' sake, as follows: A, albuminuria of pregnancy (renal fatigue syndrome); B, eclamptic and pre-eclamptic intoxication; C, nephritis and hypertension in pregnancy in patients in whom preexistent renal and/or vascular disease has reduced the renal reserve, with exacerbation of these processes of pregnancy, and D, nephritis and hypertension with definite complications, such as thyrotoxicosis, cardiac disease, acute infections or obstetric difficulties. The last group, of course, overlaps the other three and is listed separately only because of the necessity of individualization in therapy. This grouping of cases has been employed by the medical service at the Chicago Lying-In Hospital for the last several years and has proved its practical clinical value in the evaluation of the individual prognosis and determination of the mode of therapeutic attack.

REPORT OF CASES

In the last three years over 60 cases of nephritis in pregnancy have been observed and studied by the medical service at the Chicago Lying-In Hospital, from which the following data have been obtained. Of these 60, 5 were unsuitable for analytic study because of an insufficient duration of stay. The 55 cases which constitute a basis for the present report are derived from both the private and ward services. The majority have been followed up-to-date, either by direct study or by questionnaire.

The clearest presentation of the facts observed can be made by presenting the data in tabular form. (See Table I.)

It is notable that considerable variation exists in the characteristics observed, as these tabulated cases represent a mixed collection of various forms of renal disturbance. Table I, however, serves as a basis of comparison for the data observed in the individual groups. The most uniform observation is that of arterial hypertension in association with nephritis, this being noted in 87 per cent of all the cases. The arterial hypertonia must not be considered a result of the renal disturbance, but undoubtedly arises as a result of direct vascular irritation by the same factors being causative of the renal injury.[14] Analysis of the methods by which pregnancy was terminated reveals

TABLE I

FINDINGS IN ALL CASES:		NO.	PER CENT
Total number		55	
Average age		26.8	
Maximum age		42	
Minimum age		16	
Average number of pregnancies		2.4	
Maximum number of pregnancies		10	
Number of primiparas		32	60
Symptoms:			
Onset of symptoms occurred at 9 mo.		10	18
Onset of symptoms occurred at 8 mo.		15	27
Onset of symptoms occurred at 7 mo.		15	27
Onset of symptoms occurred at 6 mo.		8	14
Onset of symptoms occurred at 5 mo.		2	3
Onset of symptoms occurred at 4 mo.		3	5
Onset of symptoms occurred at 3 mo.		2	3
Onset of symptoms abrupt in		30	54
Onset of symptoms insidious in		25	46
Earliest Symptoms Noted:			
Albuminuria		20·	36
Edema		16	29
Cephalalgia		13	23
Visual disturbances		3	5
Coma		1	2
Asthenia		1	2
Asymptomatic hypertension		10	18
Icterus		1	2
Hypertension occurred in		48	87
Average arterial tension	177/113		
Maximum arterial tension	256/180		
Associated Complications Observed:			
Cardiac decompensation		3	5
Acute infective nephritis		1	2
Thyrotoxicosis		1	2
Impaired renal reserve (functional tests)		41	74
Fever		6	11
Syphilis		3	5
Marked anemia		3	5
Arsenical poisoning (arsphenamine)		1	2
Recurrent eclampsia		1	2
Convulsions		4	7
Hematuria (gross)		2	4
Delivery:			
Delivered at 9 mo.		21	38
Delivered at 8 mo.		20	36
Delivered at 7 mo.		8	14
Delivered at 6 mo.		2	3
Aborted at 5 mo.		1	2
Aborted at 4 mo.		1	2
Aborted at 3 mo.		2	3
Delivered spontaneously		25	45
Delivered by cesarean section		8	14
Delivered by vaginal section		4	6
Delivery induced by gauze		6	11
Delivery induced by oleum ricini and quinine		5	9
Delivery induced by bag		2	3
Delivered by version		1	2
Aborted (surgically)		4	7
Deaths:		2	4

that approximately half delivered spontaneously; only in approximately 10 per cent of the cases was delivery prior to fetal viability necessary. A maternal mortality of only 4 per cent may be considered as evidence confirming the wisdom of the methods of therapy chosen.

Of physiologic rather than pathologic interest is the observation that in 85 per cent of these patients a notable postpartum rise in arterial tension occurred coincidently with the onset of lactation. This rise is associated with a transient diminution of the circulating blood calcium[16] and occurs in both those patients with normal and with raised arterial tension. The calcium content of the blood is probably of no great significance in the etiology of abnormally elevated arterial tonus but is a factor in the control of physiologic variation in the arterial tension.[16]

Of greater significance and interest are the analyses of the specific clinical groups of nephritis in pregnancy as observed in this series.

TABLE II

GROUP A. SYNDROME OF RENAL FATIGUE IN PREGNANCY	NO.	PER CENT
Total number of cases	21	
Average age	26.4	
Average number of pregnancies	1.8	
Maximum number of pregnancies	5	
Number of primipara	11	52
Symptoms:		
Onset occurred on the average at 8 mo.		
Onset was abrupt in	14	68
Onset was insidious in	7	35
Edema most conspicuous symptom in	8	40
Albuminuria most conspicuous symptom in	9	50
Arterial hypertension most conspicuous symptom in	3	14
Asthenia most conspicuous symptom in	1	5
Average arterial tension 153/97		
Associated Complications Observed:		
Residual nephritis on discharge	3	14
Fetal death	4	20
Syphilis	2	10
Thyrotoxicosis	1	5
Infection	3	14
Marked anemia	3	14
Low renal reserve (on functional tests)	10	50
Delivery: Delivered on average at 8.6 mo.		
Spontaneous labor	14	66
Labor induced	3	14
Cesarean section	4	20
Deaths:	0	0
Late Results: From 6 mo. to 3 years.		
In good condition	15	71
In fair condition	1	5
In poor condition	0	0
In bad condition	0	0
Unknown	5	24

Group A. The Syndrome of Renal Fatigue in Pregnancy.—This group, often erroneously designated as "the low reserve kidney," represents approximately 40 per cent of the total number of nephritides in pregnancy. Other clinics report an incidence of 35 per cent.[12] (See Table II.) The most notable characteristics of this group are revealed in the character of the onset of symptoms, the relatively low average level of the arterial tension, the late appearance of the disturbance, the late average date of delivery, the absence of any maternal deaths, and the excellent late results from six months to three years after the pregnancy.

The average onset of symptoms was at eight months, and the onset was abrupt in 68 per cent of cases. The most frequent clinical findings were albuminuria, moderate edema, moderate elevation of the arterial tension. In half the patients a reduction of the renal reserve was

TABLE III

GROUP B.　ECLAMPTIC INTOXICATION	NO.	PER CENT
Total number of cases	14	
Average age	26	
Average number of pregnancies	3.2	
Maximum number of pregnancies	10	
Number of primipara	8	57
Symptoms:		
Onset occurred on the average at　　7.5 mo.		
Onset was abrupt in	13	92
Onset was insidious in	1	7
Albuminuria was most conspicuous symptom in	4	28
Profound intoxication was most conspicuous symptom in	4	28
Edema was most conspicuous symptom in	1	7
Coma was most conspicuous symptom in	1	7
Arterial hypertension was most conspicuous symptom in	3	21
Icterus was most conspicuous symptom in	1	7
Average arterial tension　　185/115		
Associated Complicating Factors:		
Fetal deaths	6	43
Appendiceal abscess	1	7
Left hospital in poor condition	5	35
Low renal reserve (on functional tests)	11	80
Delivery:　Delivered on average at　　8 mo.		
Spontaneous labor	5	35
Induced labor	3	21
Aborted	2	14
Cesarean section	2	14
Vaginal section	2	14
Deaths:　From postpartum convulsion at 7 mo.	1	7
Late Results:　From 6 mo. to 3 years later.		
In good condition	6	43
In fair condition	0	0
In poor condition	0	0
In bad condition	1	7
Unknown	7	50

manifest by a failure of the kidneys to secrete urine of adequate specific gravity following deprivation of water for from fourteen to eighteen hours.[15, 17] The ability of the kidneys to concentrate the urine adequately may be taken as the most significant single criterion of the renal functional reserve.[15, 18, 19] These patients were delivered on an average at 8.6 months of gestation, or very close to full term. Characteristic of the group is the excellent repair and return to full normal health after the termination of pregnancy. Of the patients whom we were able to follow for a considerable period of time, 94 per cent were in good health, 6 per cent in fair health, and no known instances of poor or bad health were observed. This evidence of an excellent prognosis is in sharp contrast with the observations in Group C.

Group B. Eclamptic or Preeclamptic Intoxication.—Here an entirely different clinical picture is manifest. (See Table III.) An abrupt, almost explosive, onset of symptoms occurred in 92 per cent of these preeclamptic patients, who comprise approximately 30 per cent of these women with nephritis in pregnancy. The intoxication is more profound than in either of the other groups; edema and albuminuria become relatively less significant. Marked icterus, evidencing hepatic injury, is observed here, but not in Group A or Group C. The onset of symptoms occurs moderately early, at seven and a half months of pregnancy on the average, in contrast with eight months in Group A. The average arterial tension for the group is considerably higher and particularly is the marked diastolic hypertonia of interest. The incidence of primipara is almost uniform throughout the three groups.

Delivery was earlier on the average in these patients than in those suffering from the syndrome of renal fatigue in pregnancy and surgical interference was far more frequent and necessary. One death occurred in this group from postpartum convulsions of an eclampsia occurring at seven months gestation. The follow-up studies reveal that, although the immediate prognosis is notoriously precarious, the late prognosis is essentially good, and little evidence of permanent residual injury is noted. The repair following this profound intoxication is relatively slow as revealed by the fact that a third of these patients left the hospital in poor condition. During the intoxication a reduction of the renal ability to concentrate the urine adequately was noted in 80 per cent of the patients.

The clinical syndrome of eclamptic or preeclamptic intoxication in pregnancy may be briefly characterized as follows: An acute, sudden, and abrupt profound intoxication of the entire body coming on usually in the midst of the third trimester of pregnancy, associated with marked hepatic, vascular, and cerebral, as well as renal injury, having a relatively poor immediate but good late prognosis. The intoxication

is of unknown chemical nature and of uncertain source, but is clearly attributable to some aspect of the pregnant state.

Group C. Nephritis in Pregnancy With Preexisting Vascular and / or Renal Disease.—In many respects this is the most interesting of all the groups, as clinically, pathologically, etiologically and regarding the prognosis it represents the superimposition of two distinct disease processes. Attempts have been made to place hypertensive arterial disease as a subdivision of nephritis.[12] Such a classification is absurd,[15] as arterial disease is a clearly individual clinical entity and, although it is frequently associated with renal disease, is rarely dependent upon the renal disturbance. This group of cases constitute approximately 40 per cent of the total number of cases of nephritis in pregnancy in this series. Other reports[12] place the incidence as low as 25 per cent of all gestation intoxications.

TABLE IV

GROUP C. WITH PREEXISTING VASCULAR AND/OR RENAL DISEASE	NO.	PER CENT
Total number of cases	20	40
Average age	28.4	
Average number of pregnancies	3.2	
Maximum number of pregnancies	10	
Number of primipara	11	55
Symptoms:		
Onset occurred on the average at 5.8 mo.		
Onset was abrupt in	4	20
Onset was insidious in	16	80
Symptoms first noted were: Cephalalgia	5	25
Symptoms first noted were: Albuminuria	5	25
Symptoms first noted were: Arterial hypertension	5	25
Symptoms first noted were: Edema	3	15
Symptoms first noted were: Visual disturbances	2	10
Average arterial tension 194/148		
Associated Complicating Factors:		
Reduced renal reserve (functional tests)	18	90
Marked anemia	3	15
Thyrotoxicosis	1	5
Cardiac decompensation	1	5
Fetal death	12	60
Discharged from hospital in poor condition	14	70
Delivery: Delivered on average at 7 mo.		
Spontaneous labor	8	40
Induced labor	6	30
Cesarean section	3	15
Aborted	3	15
Deaths:		
Cardiac failure postpartum at 8 mo.	1	5
Late Results: From 6 mo. to 3 years later.		
In good condition	0	0
In fair condition	3	15
In poor condition	9	45
In bad condition (1 died since)	5	25
Unknown	3	15

The clinical syndrome of preexisting renal and/or vascular disease with superimposed pregnancy is characteristic and clearly defined. (See Table IV.) In contrast with the other groups the onset of subjective and objective symptoms occurs much earlier in the course of pregnancy, averaging five and eight-tenths months. The onset is insidious and arterial hypertension is most pronounced. In the present series the average arterial tension of patients of this group was 194/148; a remarkable average diastolic hypertonia. However, the relative rise in arterial tension during the course of pregnancy is no greater than in the other forms of intoxication with nephritis. Early delivery is the rule, the average delivery being at seven months gestation. About one-third of the deliveries were by surgical intervention.

An essential characteristic of the group is the frequency with which the renal functional reserve is impaired (in 90 per cent), and the failure of these patients to show much improvement in the vascular and renal disturbances after termination of pregnancy. The phenolsulphonephthalein test of renal function, although frequently altered at the end of pregnancy[20] is of relatively little value as an index to the *reserve* of renal efficiency. At the end of the puerperium the arterial tension and urinary findings are not normal.[21] Nor is much rehabilitation to be expected later, as shown by the follow-up studies which revealed that up to three years after their hospital observation 80 per cent of followed cases were in poor or bad condition. Each succeeding pregnancy leads to further renal degeneration and further exacerbation of the vascular disease, with increasing evidence of arteriosclerosis.[27]

Cardiac inadequacy and severe anemia[28] are to be dreaded in these patients either during the exacerbation in pregnancy or following it. Every effort must be made to spare the heart. The fetal mortality of 60 per cent is the highest of any of the forms of nephritis in pregnancy. Retinitis is found here most frequently, although it also occurs in the syndrome of renal fatigue (Group A).[22] Retinitis is said not to occur in true eclampsia or preeclampsia.[23] The retinitis is chiefly vascular[24] and rarely is impairment of vision permanent[25] unless retinal hemorrhages occur.

Group D. Nephritis in Pregnancy With Additional Complications.— The patients in this group of course overlap into the other divisions. Seven cases of the 55 fall into this classification, of which 6 were also of Group A, and one also of Group C. The complicating factors were: active syphilis twice, acute puerperal infections twice, cardiac exhaustion once, pyelitis once, and severe anemia once. Arsenical intoxication from overly enthusiastic antiluetic therapy was responsible, at least in part, for one instance of nephritis in pregnancy in the present series. Arsenical and mercurial preparations are two-edged swords[29].

and, as they injure primarily the liver and kidneys,[30] are particularly dangerous during gestation.

In this group the problem of diagnosis, therapy, and prognosis are, of course, purely individual and do not concern the main theme of the report. Anuria is most unusual.[31]

COMMENT

To discuss adequately the multiple problems and aspects of the field of renal and vascular disease both in or independent of pregnancy is beyond the scope of the present report. It is desirable, however, that several specific aspects be dealt with briefly. Of particular significance here are the etiologic factors productive of nephritis in pregnancy, the pathogenesis of the changes therein, the logical foundation for intelligent therapy, and the evaluation of the prognosis.

The etiology of the intoxication of pregnancy is still grossly obscure, and has not yet emerged from the phase of nebulous theorizing. Of the theories advanced the most probable are[12]: (1) Intoxication from fetal elements; (2) from fetal metabolites; (3) placental products; (4) biologic (anaphylactic) reactions; (5) physical chemical changes resulting from altered maternal metabolism, and (6) uremic intoxication from renal decompensation. The scientific evidence advanced in promotion of these various conceptions is not thoroughly convincing.[65] Implication of the placenta as the origin of much of the intoxication has been based upon most logical evidence.[32, 33, 34, 35] Extraneous factors, such as weather and the dietary changes of the war, affect the incidence of the eclamptic form of intoxication but are undoubtedly merely contributory rather than primary etiologic factors.[12] The chemical nature of the intoxicating substance or substances is wholly unknown.

The tissues of the whole body are involved in these intoxications; there is no evidence of a purely local renal disturbance in any instance. These intoxications cause widespread changes here, as in nephritis unassociated with pregnancy. These changes are in part, at least, probably active as protective mechanisms. We have learned to think of edema with nephritis rather than of nephritis causing edema.[15, 36, 37, 38] Even more recent work has indicated that albuminuria may be an active protective mechanism,[39, 40, 41] similar to the protection against excessive hyperglycemia afforded by the glycosuria in diabetes mellitus. Hypertension, or increased arteriolar tonicity,[15] is perhaps the best guide to the severity of these intoxications, both as regards the height of the diastolic arterial tension and also the abruptness of such elevation. Hypertensive arterial disturbances are the result of vascular irritation or intoxication, and do not imply any notable change in the circulating blood. Hence the inaccuracy of the term "toxemia" as applied to these intoxications of pregnancy.

The renal tissues are injured synchronously with the changes throughout the body. The only direct evidence of such renal injury is the observation that the renal functional efficiency is so frequently impaired. Albuminuria per se is not a certain criterion of renal injury, nor is the degree of albuminuria an adequate guide to the degree of renal damage.[15] It has been shown that the majority of the protein in the urine in nephritic albuminuria is of hepatic origin[40] and not infrequently results from metabolic changes.[42, 43] Adequate concentration of the urine under conditions of stress, such as during or following water deprivation, is however a purely renal matter and the frequent failure of the kidneys of these patients to concentrate the urine properly under such conditions of increased effort is convincing proof of direct renal inadequacy.[5, 6, 15]

Anemia in pregnancy is usual. In the absence of severe nephrotoxic intoxication recovery from such anemia is relatively prompt and complete.[44] In the instances cited in Group C, where pregnancy caused an exacerbation of preexisting renal and/or vascular disease, such prompt improvement does not occur. Energetic therapy against such anemia is indicated; it is impossible to expect prompt and effective repair and rehabilitation of tissues to occur without adequate blood supply.

That renal injury occurs is not surprising. It is within the cells of the renal parenchyma that the greatest concentration of intoxicating substances occurs. The kidney's function of ridding the body of noxious substances makes the parenchyma particularly vulnerable.

An acidosis of mild degree is said to occur in the majority of pregnant women. This is usually compensated by the buffer substances. In eclamptic patients the ammonia nitrogen of the blood is increased[45] in further effort at compensation. Acidosis is most pronounced in the intoxicated patients.[46, 47, 48] An increased production of lactic acid occurs in eclampsia.[12, 49] An uncompensated acidosis increases the renal permeability[50] and it has been shown that acid substance causes diuresis.[51] Acidification of the urine causes alkalinization of the cells of the renal parenchyma, and vice versa alkalinization of the urine causes the cells to become acid.[52] In this connection it was noted that in many of these patients the albuminuria increased greatly in intensity upon alkalinization of the urine, only to diminish rapidly with the reappearance of an acid urine. Such variations were noted both in patients on therapy with alkalies or acids and in those receiving no medication whatever. From previous researches[51, 52] and from the clinical observations made on the present group of patients, it may be concluded that alkali administration to the point of alkalinization of the urine in nephritic patients is inadvisable and not without definite risk. Diuresis is best induced with water and, if necessary, acid salts, such as calcium chloride, calcium nitrate or ammonium chloride. Indiscriminate administration of alkalies is to be deplored.[53, 51]

If edema is actually a protective mechanism in intoxicated tissues, deprivation of water is illogical therapy. Nephritis in childhood is far more successfully treated on liberal water allowance, and it has been reported[54] that dehydrating measures may precipitate symptoms of uremia.[59] With complicating cardiac exhaustion the attitude must be one of conservatism as liberal administration of fluids may and does cause acute cardiac dilatation and failure.[26] Attention to the circulatory efficiency, adequate digitalization and correction of anemia will do much toward improving the water balance of edematous patients. During the subsidence of edema the renal concentration test procedure is of course valueless; diuresis with a urine of low specific gravity occurs even though no fluids are taken orally. Edema is essentially a tissue phenomenon and not necessarily renal in origin.[55]

The degree of arterial hypertension is, in many respects, the most accurate clinical criterion of the severity of intoxication.[67] The relative hypertension, however, is more significant than the absolute degree of hypertension in evaluating the intoxication. In the patients of Group C, with preexisting vascular disease prior to pregnancy, the average arterial tension was very high; the relative rise from ante pregnancy levels is not much greater than in the other groups. In a patient nineteen years old, whose arterial tension had been 110/60 early in pregnancy, a blood pressure of 150/100 during the eighth month may indicate an intoxication from pregnancy per se as severe as that occurring in a woman of thirty-four, with an arterial tension of 190/125, if prior to pregnancy a vascular disease with hypertension existed. However, the menace does not lie solely in the intoxication; excessive arterial hypertension itself constitutes a grave menace.[15] Gradual reduction of excessive arterial hypertonia is therefore indicated. This may be accomplished most adequately, gradually, and physiologically by the oral administration of bismuth subnitrate[56, 57] in doses of gr. x, thrice daily. In the presence of profound intoxication as occurs in the preeclamptic form of intoxication, this is useless, or when extensive arteriosclerosis already exists.[58] It has proved most useful in the first group of cases, the nephroses of pregnancy or the syndrome of renal fatigue.[56, 57] It must be remembered, however, that under such therapy the arterial tension becomes a less accurate index to the intensity of the intoxication, and a false sense of security must be guarded against.

Premature termination of pregnancy is justified in certain instances of nephritis in pregnancy as with other complications.[60] In determining the most opportune time for termination of gestation clinical judgment is strained to its greatest responsibility.[66] Judgment must be based upon careful evaluation of the individual problem, weighing and considering both the medical and surgical aspects. Not only is the immediate prognosis a significant criterion but also the effect of con-

tinuing pregnancy upon the future prognosis. Preexistent renal and/ or vascular disease is permanently exacerbated and degenerative processes accelerated by pregnancy. Eclampsia is probably most safely and efficiently treated by prophylactic termination of pregnancy in the preeclamptic phase, prior to the onset of convulsions.[15, 67] The syndrome of renal fatigue rarely requires surgical or obstetric intervention.

The prognosis of nephritis in pregnancy varies with the type of renal disturbance as has been pointed out above. A severe intoxication is almost certain to leave a residuum of some irreparable permanent injury and depletion of reserve. The outlook for a subsequent normal pregnancy following eclampsia is less favorable than is generally believed.[61] Chronic nephritis exacerbated by pregnancy offers a poor future prognosis.[14-62] The fetal mortality is high, particularly in the nephropathies appearing relatively early in pregnancy.[63] The late prognosis has been inadequately studied.[64] It may be concluded that the most essential criteria of the immediate prognosis is the severity of the relative arterial hypertension as an index to the severity of the intoxication and the extent of depletion of the renal reserve as measured by the renal concentration test. Evaluation of the future prognosis should be based upon: (1) the degree of anemia; (2) the degree of renal functional impairment; (3) the age of the patient; (4) the promptness with which improvement occurs following obstetric delivery and the degree of such improvement. Of these factors the last is perhaps the most significant. Clinical experience has taught that the earlier in pregnancy evidences of renal injury appear, the more extensive is the renal depletion and the less is the reserve.[66]

SUMMARY

1. Nephritis in pregnancy is clearly divisible into three major classes:
    A. The nephritis of pregnancy (syndrome of renal fatigue in pregnancy).
    B. Eclamptic intoxication.
    C. Preexisting renal and/or vascular disease exacerbated by pregnancy.

2. A fourth group includes all those cases having other complications, such as cardiac disease, thyrotoxicosis, infections, and obstetric difficulties.

3. Each of these groups is clearly defined and retains individual characteristics.

4. The clinical syndrome, date and type of onset, associated changes, mode of therapeutic attack, and the prognosis differ in each group.

5. These differences have been pointed out and discussed.

6. Efficient therapy can be obtained only through proper recognition of the type of renal disease, careful consideration of the causative factors of the renal injury, and constant cognizance of the condition of the patient. It is not the disease which requires treatment, but the patient.

REFERENCES

(1) *Stander, H. J., Duncan, E. E., and Sisson, N. E.:* AM. J. OBST. & GYNEC. 9: 44, 1926. (2) *Hinselman, H.:* "Die Eklampsie," Bonn, 1924. (3) *Losee, J. R., and Van Slyke, D. D.:* Trans. New York Acad. Med., Dec., 1916. (4) *Schmidt, H. R., and Wingen, T.:* Arch. f. Gynäk. 133: 127, 1928. (5) *Schmidt, H. R., Bickenbach, W., and Jonen, P.:* Ztschr. f. Geburtsh. u. Gynäk. 91: 55, 1927. (6) *Allan, W.:* Surg. Gynec. Obst. 47: 669, November, 1928. (7) *Mussey, R. D., and Kieth, N. M.:* AM. J. OBST. & GYNEC. 15: 366, March, 1928. (8) *Von Jaschke, R. T.:* Zentralbl. f. Gynäk. 45: 1837, 1921. (9) *Leyden:* Ztschr. f. klin. Med. 2: 171, 1881. (10) *Baer, J. L.:* J. A. M. A. 79: 622, 1922. (11) *Heynemann, T.:* Zentralbl. f. Gynäk. 51: 518, 1927. (12) *Stander, H. J.:* "The Toxemias of Pregnancy," Williams & Wilkins, Baltimore, 1929. (13) *Stander, H. J., and Peckham, C. H.:* AM. J. OBST. & GYNEC. 11: 583, 1926. (14) *Stieglitz, E. J.:* Illinois M. J. 50: 234, September, 1926. (15) *Stieglitz, E. J.:* "Arterial Hypertension," P. B. Hoeber, Inc., New York, 1930. (16) *Stieglitz, E. J.:* Arch. Int. Med. 39: 465, April, 1927. (17) *Fishberg, A. M.:* Arch. Int. Med. 38: 259, 1926. (18) *Stieglitz, E. J.:* Am. J. Anat. 29: 33, 1921. (19) *Stieglitz, E. J.:* Arch. Int. Med. 33: 58, 1924. (20) *Sonderer, F. E., and Harvey, T. W.:* Bull. Lying-In Hospital 8: 172, 1912. (21) *Stander, H. J., and Peckham, C. H.:* Bull. Johns Hopkins Hosp. 38: 227, 1926. (22) *Rochet, G. F.:* Tijdscher. v. Genees. 71: 1569, 1927. (23) *Miller, J. R.:* Am. J. Obst. 73: 253, 1915. (24) *Kolbert, V.:* Ztschr. f. klin. Med. 106: 449, 1927. (25) *Couvelaire, M.:* Bull. de la Soc. d'Obst. et de Gyn. 6: 238, 1920. (26) *Jaschke, von R. T.:* Arch. f. Gynäk. 114: 255, 1921. (27) *Hussy, P.:* Ztschr. f. Geburtsh. u. Gynäk. 91: 60, 1927. (28) *Lyons, E. C.:* J. A. M. A. 92: 11, Jan. 5, 1929. (29) *Stieglitz, E. J.:* Illinois M. J. 52: 301, October, 1927. (30) *Ullmann, K.:* Wien. med. Wchnschr. 78: 1389, 1928. (31) *Hirst:* AM. J. OBST. & GYNEC. 12: 673, 1926. (32) *Frey, F.:* Schweiz. med. Wchnschr. 54: 134, 1924. (33) *Wigger, C.:* Monatschr. f. Geburtsh. u. Gynäk. 78: 183, 1928. (34) *Selitzky, S.:* Gynéc. et obst. 11: 191, 1925. (35) *Bory:* Progrès méd. 46: 12, 1918. (36) *Aldrich, C. A., and McClure, W. B.:* J. A. M. A. 82: 293, July 28, 1923. (37) *Aldrich, C. A., and McClure, W. B.:* J. A. M. A. 83: 1425, May 3, 1924. (38) *Aldrich, C. A.:* J. A. M. A. 84: 481, Feb. 14, 1925. (39) *Andrews, E.:* Arch. Int. Med. 40: 548, October, 1927. (40) *Andrews, E., and Thomas, W. A.:* J. A. M. A. 90: 539, Feb. 18, 1928. (41) *Andrews, E., Thomas, W. A., and Welker, W. F.:* Arch. Int. Med. 43: 139, January, 1929. (42) *Epstein:* Am. J. M. Sc. 154: 638, 1917. (43) *Epstein:* Am. J. M. Sc. 167: 63, 1922. (44) *Bland, P. B., and Goldstein, L.:* J. A. M. A. 93: 582, Aug. 24, 1929. (45) *Zweifel, E.:* Arch. f. Gynäk. 72: 1, 1904. (46) *Vazza:* Ann. di ostet. 49: 301, 1927. (47) *Manack, J., and Boone, W.:* Brit. J. Exper. Path. 6: 261, 1923. (48) *Gaebler, O. H., and Rosen, G. L.:* AM. J. OBST. & GYNEC. 15: 808, 1928. (49) *Zweifel, E., and Schiller, R.:* Zentralbl. f. Gynäk. 51: 655, 1927. (50) *Hamburger, H. J., and Brinkmann:* Biochem. Ztschr. 88: 97, 1918. (51) *Stieglitz, E. J.:* Arch. Int. Med. 41: 10, January, 1928. (52) *Stieglitz, E. J.:* Arch. Int. Med. 33: 483, April, 1924. (53) *Rivett, L. C.:* Brit. M. J. 2: 1050, Dec. 7, 1929. (54) *Aldrich, C. A.:* Proc. Inst. Med., Chicago 8: 32, February, 1930. (55) *Loeb, L.:* "Edema," Williams and Wilkins, Baltimore, 1923. (56) *Stieglitz, E. J.:* J. Pharmacol. & Exper. Therap. 32: 23, November, 1927. (57) *Stieglitz, E. J.:* J. Pharmacol. & Exper. Therap. 35: 407, December, 1928. (58) *Stieglitz, E. J.:* Arch. Int. Med. 46: 227, Aug., 1930. (59) *Aldrich, C. A.:* Am. J. Dis. Child. 39: 456, February, 1930. (60) *Williams, J. W.:* J. A. M. A. 91: 1237, Oct. 27, 1928. (61) *Peckham, C. H.:* Bull. Johns Hopkins Hosp. 45: 176, September, 1929. (62) *Mussey, R. D., and Keith, N. M.:* J. A. M. A. 91: 2044, Dec. 29, 1928. (63) *Ewald, A.:* Deutsch. med. Wchnschr. 55: 308, Feb. 22, 1929. (64) *Sym, J. C. B.:* Lancet 2: 698, Oct. 5, 1929. (65) *Johnston, R. A., Johnson, H. W., and Nichols, H. O.:* Texas State J. Med. 25: 515, December, 1929. (66) *Adair, F. L.:* Journal-Lancet 48: 535, December, 1928. (67) *Adair, F. L.:* Minnesota Med. 7: 170, March, 1924.

A STATISTICAL STUDY OF PLACENTA PREVIA AT THE JOHNS HOPKINS HOSPITAL

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FROM the opening of the Department of Obstetrics of the Johns Hopkins Hospital on August 17, 1896, to May 1, 1930, 146 women have been admitted suffering from placenta previa during the last trimester of pregnancy. The number of cases is too small for definitive statistical study, but it represents the experience of thirty-four years in a clinic which has had over 36,000 admissions. For this reason, it has seemed worth while to analyze our material in an effort to appraise the results, fetal and maternal, from the point of view of the type of therapy which may offer the best results in this serious complication of pregnancy; although it must be admitted that whatever conclusions may be drawn are based upon too few cases to be binding. The present time seems peculiarly fitting for such an analysis since a great deal has been written recently concerning the treatment of placenta previa by cesarean section, and since the general policy of this Clinic has been along more conservative lines.

We have studied the material from three angles: first, to ascertain the incidence of placenta previa, both in clinic practice and in the childbearing population at large, with particular reference to the effect of color and parity; second, to learn the results to the mother; and third, to ascertain the outcome to the child.

INCIDENCE

This service has always been practically equally divided as to black and white patients. Likewise, the number of primiparae and multiparae is approximately the same. During the period of almost thirty-five years covered by this report, there have been filed in the Record Room the histories of 36,198 obstetric patients. Of these 22,646 were admitted to the hospital, and 13,552 were taken care of in their homes. As it is the policy to admit at once to the hospital any patient on the Out-Patient Service who develops an abnormality, it seems proper to include such patients in determining the incidence of placenta previa.

In the total admissions to the service the incidence of placenta previa is 1 to 248. If, however, we restrict our study to patients who have been delivered by us after the pregnancy has reached the period of viability for the child, the total cases become reduced to 31,198, and the gross incidence of placenta previa is increased to 1 in 214.

The great majority of the women were registered in the Dispensary for prenatal care, and represent a fair normal cross-section of the

population. On the other hand, 5 per cent of the Out-Patient Service and 11 per cent of the Hospital patients were accepted as emergency cases, and represent a distinctly abnormal population with a very high incidence of obstetric complications. Fifty-seven of the cases of placenta previa fall in the former and 87 in the latter group, while in 2 instances this point was not noted. In other words, the incidence of placenta previa was 1 to 30 in the emergency, as compared with 1 to 499 in the registered patients.

A consideration of the cases delivered in the hospital in the last third of pregnancy brings to light an interesting point, and that is that the incidence of placenta previa is definitely higher in white than in black women, our incidence being 1 in 98, and 1 in 158, respectively. This difference is particularly marked in the white multiparae, as our figures are practically identical for primiparae of both races, 1 to 507, and 1 to 544, respectively; whereas, placenta previa occurred once in every 52 white multiparae as compared with once in every 80 black multiparae admitted to the hospital. No explanation for this significant racial difference presents itself at this time. Indeed, it is contrary to what one would expect from a priori reasoning.

MATERNAL MORTALITY

In the total series of 146 cases there were 16 maternal deaths, an uncorrected mortality of 10.96 per cent. Analysis shows 9 deaths in

TABLE I

TYPE	CASES	MATERNAL DEATHS	MORTALITY PER CENT
1896-1930			
Central	28	6	21.43
Partial	61	9	14.75
Marginal	57	1	1.75
Total	146	16	10.96
1896-1909			
Central	7	2	28.57
Partial	9	3	33.33
Marginal	10	0	00.00
Total	26	5	19.23
1910-1919			
Central	6	1	16.67
Partial	18	2	11.11
Marginal	15	1	6.67
Total	39	4	10.26
1920-May 1, 1930			
Central	15	3	20.00
Partial	34	4	11.76
Marginal	32	0	00.00
Total	81	7	8.64

93 cases in white women (9.68 per cent), and 7 deaths in 53 black women (13.21 per cent).

In an effort to ascertain whether or not any improvement has occurred in the maternal mortality rate during recent years, and more particularly since transfusion has become a relatively simple procedure, the patients were divided according as they had occurred prior to 1910, between 1910 and 1919, or from 1920 onward; and the results are given in Table I.

It will be seen that the mortality during the past ten years is less than half that during the first fourteen years of the service. This is probably due to the fact that many of the women in the earlier group were delivered by accouchement forcé, that is, manual dilatation of the cervix soon after admission followed by version and extraction; whereas the custom since then has been the employment of the Voorhees bag, with delivery only after the cervix has become fully effaced.

In general, it may be said that the mortality in marginal placenta previa is very low, 1 in 57 cases, whereas partial and central placenta previa offer a much more serious prognosis. Table I shows that the greatest improvement has occurred in the partial type, and that the mortality from the central type is still very high. At the same time, it should be mentioned that many of the deaths occurred in women admitted to the service after severe and prolonged bleeding at home and that several were practically moribund when first seen.

Condition on Admission.—The patients were next grouped according to their physical condition on admission. If the hemorrhage had been slight, the pulse slow and of good tension, and the general physical impression satisfactory, they were classified as excellent. With severe hemorrhage, rapid and thready pulse, air hunger, and a generally unfavorable impression, the condition was considered poor; while when the findings lay between these two extremes the condition was designated as fair.

TABLE II

TYPE	EXCELLENT			FAIR			POOR		
	CASES	MATER- NAL DEATHS	MORTAL- ITY PER CENT	CASES	MATER- NAL DEATHS	MORTAL- ITY PER CENT	CASES	MATER- NAL DEATHS	MORTAL- ITY PER CENT
Central	16	2	12.50	4	1	25.00	8	3	37.50
Partial	48	4	8.33	6	2	33.00	7	3	42.86
Marginal	48	0	00.00	5	0	00.00	4	1	25.00
Totals	112	6	5.36	15	3	20.00	19	7	36.84

Table II shows that the mortality varied from 5.36 to 36.84 per cent according to the condition of the patient when first seen, and that all but one of the deaths occurred in the central and partial types.

Pulse.—The pulse rate on admission was investigated in its bearing upon maternal mortality, since it is one of the best indices as to the condition of the patient.

Table III needs little comment, as it merely shows that the prognosis varies with the general condition of the patient. It is, however, noteworthy that no death occurred among the 33 women whose pulse was below 90 on admission.

TABLE III

PULSE RATE	CASES	MATERNAL DEATHS	MORTALITY PER CENT
Below 90	33	0	0.00
90 to 119	71	6	8.45
120 to 139	28	4	14.29
140 and over	11	4	36.36
Unable to count	3	2	66.67

Extent of Hemorrhage Before Admission.—

TABLE IV

HEMORRHAGE	CASES	MATERNAL DEATHS	MORTALITY PER CENT
None	5	0	0.00
Slight	53	4	7.55
Moderate	37	3	8.11
Profuse	51	9	17.65

Five patients who were admitted to the hospital prior to the onset of labor later developed bleeding and were found to have placenta previa. As with poor general condition and rapid pulse, the highest mortality occurred in women who were admitted after profuse hemorrhage, and was 17.65 per cent.

*Cervix.—*A few patients were admitted prior to the onset of pains, but in most instances labor had set in before admission and had resulted in varying degrees of cervical dilatation. Table V indicates that in our cases the prognosis became graver as the dilatation increased. In other words, the degree of dilatation affords a rough index of the degree of placental separation and of the extent of hemorrhage. This, however, is not a universal rule, as several patients who were admitted with a cervix less than 3 cm. dilated had bled profusely at home.

TABLE V

CONDITION OF CERVIX	CASES	MATERNAL DEATHS	MORTALITY PER CENT
Closed	17	0	0.00
To 2.9 cm.	47	4	8.51
3.0 to 5.9 cm.	58	5	8.62
6.0 to 8.9 cm.	15	4	26.67
9.0 to fully	5	2	40.00
Unknown	4	1	

*Time From Admission to Delivery.—*Thirty-four of the patients were delivered immediately after their arrival at the hospital. In many of

these the delivery was effected after manual dilatation of the cervix, in a few by cesarean section, while in the remainder the cervix was sufficiently dilated on admission to permit spontaneous or operative delivery. Eight deaths occurred in this group, or 23.53 per cent. Fifty-two other patients were delivered in less than six hours with 4 deaths (7.69 per cent), 34 were delivered in from six to twelve hours with 3 deaths (8.82 per cent). Thirty-five women were in the hospital over twelve hours prior to delivery and none died. One patient died undelivered three and one-half hours after admission. In other words, we have no indication from this analysis that immediate delivery decreases maternal mortality. Indeed, it would seem that postponing delivery until after the initial shock is over and the patient's general condition improves offers the most favorable prognosis.

Duration of Pregnancy.—It has long been known that a large proportion of cases of placenta previa become manifest before the patient has reached term. That such was the case in our series will be seen from Table VI. The division is made by lunar months rather than by calendar months.

TABLE VI

DURATION	CASES	PER CENT OF TOTAL
6 to 6.9 lunar months	10	6.85
7 to 7.9 lunar months	26	17.81
8 to 8.9 lunar months	30	20.55
9 to term	21	14.38
Term	56	38.36
Unknown	3	2.05
	146	100.00

In other words, about three-fifths of the patients in whom the duration of pregnancy could be ascertained with any degree of accuracy were before term. The white women in general carried the pregnancy longer than did the black, and 43.96 per cent of the former and 30.77 per cent of the latter reached full term; while the average duration of pregnancy was 8.75 and 8.36 lunar months in the two races, respectively. If now the maternal mortality is considered in relation to the duration of pregnancy, we find that 66 patients were delivered prior to the last month of pregnancy. Three of these died, a mortality of 4.55 per cent. On the other hand, 77 cases of placenta previa were delivered at term or during the last month of pregnancy with 12 deaths, a mortality of 15.58 per cent, which is over three times as great as in the premature cases.

Possibly the amount of placental separation and hence the hemorrhage is less in the cases terminating prematurely. Certainly the prognosis becomes increasingly grave as the patient approaches term before the onset of severe symptoms.

Weight of Child.—Since the maternal mortality was found to be lower in the cases admitted prior to the last month of pregnancy, it was

thought advisable to compare it with the size of the child at birth. In 10 instances the weight of the child was not noted; but in the 63 cases in which it weighed under 2500 gm. there were 2 maternal deaths, 3.17 per cent, as compared with 11 deaths or 15.07 per cent in 73 cases in which it weighed 2500 gm. or more. These figures coincide closely with the experience noted in the preceding paragraph, when the mortality was considered according to the duration of the pregnancy. We must admit that the maternal mortality rate is highest in those patients whose babies, from the point of view of weight, have the best chance of survival.

Parity.—Multiparity is considered a predisposing factor in the etiology of placenta previa. Since with multiparity goes an increased obstetric age, these factors were next considered in their influence on maternal death. Twenty-two of the cases in this group occurred in the primiparae, or 15.28 per cent, as compared with 13 (9.03 per cent) in women who had had ten or more previous pregnancies. The average parity of the white women was 4.54 and of the black 4.12. It is interesting to note that of the 28 cases of central placenta previa only two occurred in primiparae and both recovered. Furthermore, in the group of 22 primiparae there was only one maternal death, 4.55 per cent; while in multiparae the average mortality was 11.48 per cent, rising to 23.08 per cent in the group of women who had given birth to ten or more children.

Age.—Table VII.

A study of the age of the mother results similarly. The age of two patients was not given in the histories. Ten women were under twenty (6.85 per cent), and 16 were forty or more years of age (10.96 per cent). The average age for the entire group was 30.30 years, being higher in the white than in the black women, 31.46 and 28.30 years respectively. It appears that the maternal mortality increases with the age of the mother, and attains the high figure of 31.26 per cent in those who had reached the age of forty.

TABLE VII

AGE	CASES	DEATHS	MORTALITY PER CENT
To 20 years	10	1	10.00
20 to 29	53	3	5.66
30 to 39	65	7	10.77
40 and over	16	5	31.25
Unknown	2	0	0.00

Presentation.—The incidence of abnormal presentations has long been known to be high in placenta previa. Such was found to be the case in this series, and transverse, breech, and compound presentations comprised 26.03 per cent of the total. That the maternal mortality in the abnormal presentations (5.26 per cent) was lower than in the vertex (12.96 per cent) is undoubtedly due to the fact that they occur mostly

with prematurity, and we have already seen that the death rate is lower in that group.

Treatment.—The mode of delivery may be briefly indicated. Nineteen women were delivered at once by manual dilatation and version. Cesarean section was practiced in 5 instances. Immediate delivery, spontaneous or operative, with the cervix fully dilated or sufficiently dilated for the size of the child occurred ten times. In 99 patients a balloon was inserted and was followed later by spontaneous or operative delivery. Braxton-Hicks's version was employed in 3 instances, and in 10 in which the head was in the pelvis, the bleeding was so slight as to warrant no therapy. In 26 cases the uterus was packed postpartum. Cervical tears were recorded as severe enough to necessitate immediate repair in only 16 cases.

Puerperium.—The puerperium was febrile (temperature 100.4° on two or more days) in 43 of the 84 white women, excluding immediate deaths. This gives a febrile rate of 51.19 per cent in this race as against one of 65.96 per cent in 47 colored patients. The use of the balloon undoubtedly accounts in part for this high figure.

Analysis of Deaths.—Of the 16 women who succumbed, the death was due to infection in only one instance. This patient, admitted in good condition, bled profusely before a bag could be introduced. After delivery she developed a severe infection and died on the fiftieth day postpartum of thrombophlebitis. One patient with a marginal placenta previa and a markedly contracted pelvis, in whom bleeding had been slight, was admitted in extremis after numerous attempts at forceps delivery by her physician. She was delivered by craniotomy but died a few minutes later of shock, hemorrhage playing no rôle in her death. Another patient died of nephritis two days after cesarean section, the indication for the section, and the cause of death being the renal lesion in this case. The remaining thirteen patients died of hemorrhage and all within eight hours of admission. One was admitted almost exsanguinated and still bleeding. A bag was introduced but she died undelivered before transfusion or other intravenous therapy could be instituted. Five of these patients were admitted in poor condition, two in whom the pulse was so thready as to be uncountable, and all died within two hours of delivery. Two others were admitted in fair condition and died within two and one-half hours of delivery, while the remaining five women were in good condition when received but bled so severely after delivery as to die within four hours. Omitting the six patients who came to the hospital in desperate shape, the death from nephritis and the one due to shock, we reach a corrected mortality of 5.80 per cent, for whose death the Clinic was directly responsible.

Fetal Mortality.—In this series, there were only 47 babies discharged alive from the hospital. Most of the rest were stillborn, although there

were a few deaths from prematurity among those born alive. The gross fetal mortality then was 67.81 per cent, and was lower in the white (63.44 per cent) than in the black race (75.47 per cent). Naturally the mortality was highest in the cases of central placenta previa, being 89.29 per cent. In the partial group there were 77.05 per cent dead babies, which fell in the marginal group to 47.37 per cent.

Many of the babies were premature and the average weight of the white infants was 2698 gm., as compared with 2377 gm. in the black race. As will be seen from the following table, the greater the weight of the baby the better its chance for survival.

TABLE VIII

WEIGHT	CASES	FETAL DEATHS	INFANT MORTALITY PER CENT
To 1500 gm.	17	17	100.00
1500 to 1999 gm.	23	21	91.30
2000 to 2499 gm.	23	16	69.57
2500 to 2999 gm.	23	12	52.17
3000 to 3499 gm.	28	14	50.00
3500 to 3999 gm.	16	5	31.25
4000 and over	6	4	66.67
Unknown	10	10	

In just over a quarter of the cases the child was already dead on admission as the fetal heart could not be heard. This occurred most often in the central and least often in the marginal type of placenta previa. If we omit the cases in which the child was dead on admission, we obtain a fetal mortality of 50.53 per cent. Many of these children were premature, and considering only such babies as were known to be alive on admission and which weighed at least 2500 gm., the fetal mortality was 38.71 per cent.

Finally, an investigation was made as to the effect of the lapse of time from admission to the hospital to delivery, when the fetal heart was present on admission and the child weighed 2500 gm. or more.

TABLE IX

DELIVERY	CASES	FETAL DEATHS	INFANT MORTALITY PER CENT
Immediate	11	5	45.45
0 to 2.9 hours	6	3	50.00
3 to 5.9 hours	18	5	27.78
6 to 8.9 hours	11	4	36.36
9 to 11.9 hours	4	2	50.00
12 and over	12	5	38.71

Although each of these groups is too small for definite conclusions, one nevertheless gains the impression that this factor has little if any effect upon the prognosis for the child and the results are no better after immediate delivery from below than when a number of hours elapse before the child is born.

DISCUSSION

In a service of over 36,000 admissions, and extending over a period of almost thirty-five years, placenta previa occurred in 146 instances, or approximately 1 in 250. Emergency admissions to the hospital service comprise only a small part of the total cases but include a larger percentage of the total cases of placenta previa. Thus, in women admitted as emergency cases and delivered on the service the incidence is 1 in 30, whereas among those registered for prenatal care it is 1 in 500. This last figure seems to represent fairly accurately the occurrence of this complication in a typical cross-section of the child-bearing population.

There is a rather surprising racial difference in the incidence of placenta previa. In a service divided about equally between whites and blacks, and between primiparae and multiparae, it is seen that it occurs once in every 98 deliveries in white women, as compared with once in every 158 in black women. In view of the greater average number of pregnancies among the black women, such a finding is difficult to explain.

The gross maternal mortality for the series was 10.96 per cent. It is comparatively higher in the black than in the white race, being 13.21 per cent and 9.68 per cent respectively. During the early days of the Clinic a number of the patients were delivered immediately after entering the hospital by manual dilatation of the cervix and extraction of the child. This practice was soon given up and since then the hydrostatic bag has been commonly employed. At the present time, the treatment of cases admitted with vaginal bleeding during the last third of pregnancy is as follows: A sample of blood is obtained at once, and preparations made for securing compatible blood donors, with the idea of being ready for transfusion as soon as possible. If the patient's condition is not critical this procedure is held in abeyance for the time being. If, however, the woman is suffering·from the loss of blood, an intravenous injection of saline or glucose is begun immediately and is followed by transfusion as soon as the necessary preparations can be made. Meanwhile, the patient is taken to the operating room. All necessary preparations are made for the introduction of a bag. A vaginal examination is now done and if the bleeding is found due to placenta previa, the bag is inserted intraovularly at once. The patient is then returned to bed, mild traction exerted by means of a weight attached to the bag and suspended over the edge of the bed. Immediate delivery is effected after extrusion of the bag, the cervix is inspected for tears, and if there is any bleeding following the third stage of labor the uterus is packed prophylactically. Throughout labor and for some hours after delivery, the patient is constantly watched and donors for transfusion are kept on the delivery floor so that this procedure can be carried out without delay if it becomes

necessary. It is strongly felt that the immediate and free use of transfusion aids materially in reducing the mortality incident to placenta previa.

That the maternal death rate from placenta previa has been lowered in recent years in this service is evidenced by the fact that from 1896 to 1910 it was 19.23 per cent, whereas since 1920 it has fallen to 8.64 per cent.

There is a considerably different mortality according to the type of placenta previa. In a series of 57 cases of the marginal type there was only one death (1.75 per cent); 14.75 per cent of the cases of the partial type terminated fatally, while central placenta previa in this group of cases was associated with a mortality of 21.43 per cent.

As has previously been stated a large number of the patients (87) were admitted as unregistered emergency cases and many of them were in desperate condition when first seen. Classifying the patients as excellent, fair, or poor risks according to the clinical picture on admission, we find a low mortality of 5.36 per cent when the initial examination revealed the woman to be in good condition. This figure rises in the group classed as "fair," and when the situation was deemed ominous on admission, the mortality reaches 36.84 per cent. A study of the condition of the patient from the point of view of hemorrhage before and pulse rate on admission checks the above conclusion closely. It is noteworthy that in 33 women admitted with a pulse below 90 there was not a single death.

In some cases the patients were admitted before the onset of labor, but usually, however, having had pains for a varying period of time. In general, the mortality rate rose with the duration of labor prior to admission and the beginning of therapy as indicated by the amount of cervical dilatation. However, in 17 women admitted with the cervix closed there was not a single death. In most of these the preceding hemorrhage had been slight but some had bled severely.

In view of this observation, a further division of the cases according to the hours elapsing between admission and delivery becomes of interest. The highest maternal mortality (25.53 per cent) occurred in the group delivered immediately after admission. However, in this group are included those who were delivered by accouchement forcé, as well as those admitted with a widely dilated cervix who had been bleeding throughout some hours of labor. On the other hand, there were 35 women who were delivered not less than twelve hours after admission and in this group there was not a single death.

In approximately 60 per cent of the patients the symptoms of placenta previa appeared at varying intervals before the pregnancy had reached term. In general the white patients were farther advanced than the black. Considering the maternal mortality from the point of view of duration of pregnancy, we found a rate of only 4.55 per cent

when the pregnancy ended prior to the last lunar month, whereas it was 15.58 per cent in those patients who were at or near term. Why this difference should exist is not clear, but it seems significant that the highest maternal mortality occurs in the group in which from the standpoint of the survival of the child the mortality was lowest. A consideration of the maternal death rate according to the weight of the child likewise shows a higher figure where its weight exceeds 2500 gm.

An investigation of the parity of the patients in the series showed a low mortality rate of 4.55 per cent in the primiparous women as against a much higher one in the multiparous. A considerable number of the women had had ten or more previous pregnancies and in them the mortality was highest, 23.08 per cent. Being more common in multiparae, placenta previa obviously occurs most frequently in women well along in their obstetric career. In view of this, it is interesting that the highest mortality occurs in women whose age is forty or more. In almost every way, it seems evident that the pregnant elderly women makes a very poor risk.

That we have to deal with a high incidence of febrile puerperia is not surprising, for this is to be expected in any series where operative procedures are the rule and particularly where the hydrostatic bag is commonly employed. However, only one death occurred from infection. It is noteworthy that the incidence of puerperal infection is much higher in the blacks than in the whites, a phenomenon which holds true as well for normal deliveries in the two races.

Analysis of the 16 fatal cases shows hemorrhage to be the most important factor in 13 instances. One woman died of infection, one of nephritis, and one of surgical shock, the result of operative procedures before admission. In 6 of the 13 deaths due to bleeding, the condition of the patient on admission was desperate and if these deaths, the death due to shock and to chronic nephritis, are omitted as not being directly the responsibility of the Clinic, the corrected mortality falls to 5.80 per cent.

The prognosis for the child in placenta previa is always grave, and in this series the gross fetal mortality was 67.81 per cent. This is due partially to the large number of prematurely born infants, and in our series 46.32 per cent, or almost half, weighed less than 2500 gm. The weight of the average white baby was 300 gm. more than that of the black, which coincides with a higher fetal mortality in the latter race. The mortality is highest in the central type of placenta previa and lowest in the marginal variety.

In over a quarter of the total cases the fetal heart tones were absent on the admission of the patient to the hospital. If we omit these cases from discussion (and obviously no form of therapy could alter the results here), and consider only those babies weighing 2500 gm. or

over, where the fetal heart was present on admission, the mortality falls to 38.71 per cent. Thus, it would appear that of the babies, presumably fair risks on admission, over one-third died prior to the delivery of the patient. However, the number of hours from admission to delivery made no difference in the fetal mortality and, indeed, is lower in the group delivered twelve or more hours after entering the hospital than when immediate evacuation of the uterus was practiced.

After the above considerations, what can be said concerning the treatment of placenta previa? The value of prompt and if necessary repeated transfusions seems to be without question. Very probably immediate delivery by cesarean section after admission of the cases at or near term and where the fetal heart was still in good order would result in more live babies. What effect such a procedure would have upon the maternal mortality is entirely problematical. Certainly the bag gives entirely satisfactory results in the marginal type of case. Many of the other cases are admitted in too poor condition to risk a laparotomy. In still others, bleeding is so profuse that it must be checked at once, or before any abdominal operation can be performed. Many have already had unsterile examinations on the outside before admission, some of them entering the hospital with the cervix packed, and in them indiscriminate use of cesarean section would probably increase the mortality from sepsis. It is the feeling of this Clinic at present that this operation has only a restricted scope in the treatment of placenta previa. In a central placenta previa with the cervix closed or just opening and with a viable child whose heart tones are in good order it seems permissible. In a multipara in good condition, with several live children, where sterilization seemed a reasonable procedure cesarean section with hysterectomy or tubal excision might not be condemned. In an occasional case the desire for a live child might counterbalance an increased chance for mishap to the mother. Except in these instances the use of the bag still holds as the procedure of choice, though far from an entirely satisfactory one.

CONCLUSIONS

1. The incidence of placenta previa in an average childbearing population is about 1 in every 500 deliveries. It is higher in white than in black women.

2. The maternal mortality in placenta previa is still high (8.64 per cent), although the results have improved greatly in the past thirty-five years. It could be still further reduced by the prompt hospitalization of all bleeding cases and more frequent employment of transfusion.

3. When the patient is admitted in good condition, with low pulse and before the hemorrhage has become alarming, the mortality is low and does not rise if a number of hours elapse before the patient is

ultimately delivered. The mortality is highest in those patients who are delivered immediately after admission, or before the general condition has been improved by intravenous therapy.

4. The incidence of premature labor is high, but the maternal mortality in this group is low and increases more than three times when delivery occurs at or near term.

5. About 15 per cent of the cases occur in primiparae. The incidence of central placenta previa in this group is low (9.10 per cent). The maternal mortality is much higher in multiparae and also increased as the age of the patient rises.

6. Puerperal infection occurred in over half of the cases in this group. However, only one death from infection is recorded.

7. Hemorrhage accounts for 13 of the 16 deaths in the series. Several of the women were admitted almost moribund, and omitting these as well as deaths from causes unrelated to placenta previa, the mortality falls to 5.80 per cent.

8. The prognosis for the child is grave. About one-half of the children weigh less than 2500 gm. at birth. In more than 25 per cent of the cases the fetal heart was absent on admission. Omitting these two groups, the stillborn and neonatal mortality is still very high, 38.71 per cent.

9. The treatment of placenta previa is still unsatisfactory; liberal transfusion offers the best method of reducing the mortality. The hydrostatic bag offers satisfactory results in the marginal type of case. The indiscriminate use of cesarean section, while increasing the chances for the child, would probably not reduce the maternal mortality. Many of the patients who succumb are too ill on admission, or bleeding too severely to warrant laparotomy. Others, due to unsterile examinations on the outside or the use of vaginal packs, are admitted potentially or obviously infected and in them the use of cesarean section, unless followed by hysterectomy, would be fraught with considerable danger. Cesarean section may, however, be indicated in cases of central placenta previa admitted in good condition before or early in labor, and with a living and viable child; or where the desire for a live child counterbalances any increased risk to the mother.

THE RADIATION TREATMENT OF AMENORRHEA AND STERILITY. WITH A REPORT OF CASES SO TREATED

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IN NO other subject of medicine is there so much confusion and misunderstanding prevalent as in the application of radiant energy in gynecology. Indeed the situation is such that both layman and physician regard the employment of x-rays and radium only as destructive elements. When unlooked-for disagreeable sequelae follow therapeutic uses of radium and x-rays, the whole procedure is condemned and other patients are hindered from seeking its benefits. However, in no field of treatment of the female sexual phenomena is it more helpful and more promising of spectacular results than in that of functional disorders of the ovary. In cases of sterility, where it is desired to produce offspring, radiation plays the rôle of a guardian angel in fostering a happy married life which would otherwise be barren and dreary.

Recently, however, and very regrettably, doubts appear to have been cast on the safety of this form of therapy. In the daily press not long ago there appeared an article by an alleged expert to the effect that abnormal babies or monstrosities were born of irradiated mothers. Another item, receiving equally important publicity, claimed the control of the sex of the unborn child through irradiation. Then, too, there are some honest, industrious, ethical medical men who seek out the oddities of therapeutic methods, quote statistics of rare occurrences of abnormalities, as if the latter all occurred in one associated sequence, and from such jumbling of unrelated facts draw conclusions as to supposed evils of radiation therapy.

The early workers with the x-rays and radium, noted the biologic reaction of tissues to these rays without at first clearly understanding them. The results usually were destructive. As more careful study led to better understanding of the principles of radio-activity, it was noted that radiant energy either stimulated the tissues, destroyed them, or did not affect them at all. Early in this study Bergonie and Tribondeau were able to conclude that the more embryonic the tissue the more it responded to radiant energy, and the more defined, adult, or highly differentiated the cell, the more resistant it was to radiation. The effect on gonads has been studied by Regaud, Lacassagne, Schinz, Dobrovalkaia and others. The male cells are easily affected but recuperate readily and, according to Dobrovalkaia, such male cells as are damaged by radiation and recover do not, if subsequently used in

impregnating the female, transmit such malformations. As yet no one has ever followed an injured male cell and there is no positive proof that the offspring is adversely affected by such injured cell. In Ewing's opinion, normal tissue is ordinarily unaffected by the proper therapeutic use of radiation.

The biologic action on the ovary is still undetermined. The true pathologic picture of the ovary of a woman menstruating irregularly or not at all, or in women incapable of becoming pregnant, is still unknown. The problem of sterility, which was known in Biblical times, is difficult of explanation in every case, due to the complexity of the factors involved in the phenomena causing pregnancy. Rubin, in his discussion of this subject advises consideration of all extraneous factors before attempting therapeutic interference with the ovaries. As he sees it, the aim and effect of therapy in female sterility is to correct abnormalities and to restore anatomic relations and, if possible, functional conditions to as nearly normal as possible. For the correction of the functional conditions he has recommended the employment of fractional doses of x-rays, and it was at his suggestion that I began this work in 1924. Rubin reports that over 50 per cent of his patients so treated satisfactorily became pregnant. At The Mayo Clinic, Drs. Dripp and Ford have found that irradiation is particularly applicable in cases of menstrual irregularity, whereby, excluding all other etiologic factors, an inherent disturbance of the ovaries may be assumed. Whether or not menstruation is wholly controlled by the ovary or is the result of a combined action of secretory glands distributed throughout the body, is still not thoroughly understood. In his definition of the menstrual phenomena, Howell states that the phenomenon of menstruation is dependent on the periodic activity of the ovaries, and that in most cases menstruation is connected with ovulation, the ripening and discharging of a graafian follicle.

Anspach says that ovarian impulse and uterine response are essential to the menstrual flow. The corpus luteum forms a stimulus for the next menstrual period, follicle-bearing tissue must be present in the ovary to cause menstruation, and menstruation is a complicated process of which the most obvious evidence is the menstrual flow. He says, too, that the ovary has an internal secretion which gives rise to menstrual molimina.

Westerman, however, says that in mice ovarian function proceeds normally even if the uterus is extirpated.

In his study of the circulation of the ovary, Clark states that the increased amount of blood sent to the pelvic organs during the menstrual period causes a marked augmentation of the intracapsular pressure of the ovary which results in the bursting of the graafian follicle, after which expulsion of the ovum takes place. Ovulation occurs from fourteen to sixteen days after the beginning of menstruation and then the corpus luteum begins to grow. Ovulation causes menstruation; copulation assists the ovulation, and expulsion of the ovum occurs when the graafian follicle bursts.

Reynolds says that the ovaries of sterile women on gross examination show numerous thin-walled projection follicles or numerous small imperfect corpora.

Frank believes that there is a secetory controlling hormone supplied by all the sexual glands of the body. Frankel thinks that this hormone is made up of the yellow body cells of the corpus luteum. From the standpoint of irradiation I have seen alteration of ovarian function result from the radiation of glands other than the ovaries.

Eden and Lockyer state that for menstruation there must be fully developed activating ovarian tissue and that there is some physiologic coordinating connection between the ovary and other endocrine glands. In their opinion, the chief exciting

cause of menstruation is an internal secretion of the ovary, for ovulation can occur without menstruation and vice versa. There is an ovarian hormone which excites menstrual change in the endometrium, and there is a connection between the thyroid and the ovaries.

These are all suppositions not based on positive experimental data.

Miss van Herwerden from her researches says that in monkeys there are two periods: one, when menstruation occurs with a corpus luteum and the other, when menstruation ensues without the occurrence of ovulation. Therefore, she concludes that the cause of menstruation is somewhere outside of the ovary.

Nemenow reports that in the x-ray treatment for pituitary tumor a concomitant amenorrhea was cured. Dripp has shown that small doses of x-rays to the thyroid, spleen, and pituitary areas have cured functional disorders of the ovaries.

For the control of excessive bleeding in virgins, Seitz and Wintz early made use of irradiation of the spleen with good results. Hofbauer, in 1922, before the German Gynecological Congress, suggested x-ray therapy of the pituitary for gynecologic functional disturbances, especially the effect on uterine myoma after such irradiation. Werner found that x-rays applied to the hypophysis stimulated menstrual reaction, and Borok suggested pituitary radiation for mitigating the climacteric symptoms of early menopause. Frequently, radiation stimulation of the thyroid has effected normal menstruation.

Neither the action of radiation on the ovary nor the latter's reaction to radiation is as yet clearly explained, and the mechanism of ovulation is still unknown. Histologic examination of the ovary shows the ovum lying in a mature graafian follicle surrounded by the cells of the germinal epithelia. In maturing there is a thinning of the follicular wall with increased liquor folliculi which consequently, therefore, increases intrafollicular pressure and results in the rupture of the graafian follicle and discharge of its ovum. The follicle then is filled with blood from the tearing of the vessels in the theca or covering layer, which later develops into the corpus luteum. Hartman believes that usually the corpus luteum must be present for menstruation to occur, but he has found that in the monkey, mere rupture of the graafian follicle brought on menstrual phenomena. It is, I believe, the presence of this corpus luteum that inhibits menstruation during pregnancy. Snyder, however, does not believe that the activity of the corpus luteum inhibits ovulation in primates, while Hartman, from his studies on the opossum, believes that the destruction of the corpus luteum induces destruction of the fetus and he therefore concludes its presence is necessary for pregnancy. But he believes the corpus luteum is not the cause of menstruation in the monkey. Nor is it necessary for the menstrual cycle, nor does the follicular apparatus of the ovary cause menstruation. Kast says the corpus luteum of pregnancy is of increased size and gives off internal secretions.

Experiments by Corner and Allen have shown that removal of the corpus luteum during pregnancy causes the termination of the pregnancy, and these workers therefore conclude that the presence of a corpus luteum is necessary for the pregnancy to continue.

Whitehouse says that the decidua of the upper segment of the uterus is the favorite place for the implantation of the zygote and that this decidua depends for its existence on the integrity and normal function of the corpus luteum.

Johnstone says that the reproductive cycle begins in the ovary just prior to ovulation with the maturation of the follicle, and the formation in the entire ovary, not merely in the follicle or ovarian stroma, of an ovarian hormone. As soon as ovulation has occurred, luteum tissue is formed; this creates a second hormone, which governs and stimulates the preparation in the uterus for the fertilized ovum.

We know that the x-rays have in themselves a power to stimulate. Flattau, Seitz, and Wintz declare that there is a definite stimulation effect by x-rays on the ovaries. Aschoff, Colwell, and Russ have shown that x-rays act directly on the follicular elements of the ovary, while Robinson says that only the tertiary follicles are sensitive to radiation, leaving the primary follicles to continue to ovulate after the x-ray effect has passed. Hirsch believes the action is directly on the corpus luteum; the graafian follicle is embryonic tissue and this is highly sensitive to x-rays. Lenke believes a pathologic graafian follicle, preventing the ripening of a normal follicle capable of producing menstruation, is destroyed by the x-rays, and then leaves the primary follicle free to develop. If we deem this tissue to be so radiosensitive, we can regard the action of irradiation on the ovary at this time as an action directly on a most radiosensitive tissue, which responds by releasing its inhibitory reaction on the ovary, thus allowing the usual menstrual cycle to occur.

Johnstone says that operation on a woman in the latter half of her menstrual cycle with removal of the maturing corpus luteum will cause menstruation to follow in thirty-six hours.

Hartman says the follicle in the corpus luteum is unnecessary for menstruation but the ovary is necessary; therefore, we must look to some endocrine cause within the ovary, perhaps in cooperation with other glands, for example the pituitary, and perhaps the x-rays stimulate such active hormone, causing menstruation. The anterior lobe of the pituitary, according to Johnstone, gives off two types of activating factors: the first one activates the whole ovary, leading to ovulation and the formation of lutein tissue, and a second activator which affects the corpus luteum produced by the first activator; and, he states further that these pituitary factors work only through the medium of an ovary.

Novak claims that the ovum is not the cause of menstruation, because in monkeys definite periodic bleeding occurs without ovulation; that in as much as the follicle and corpus luteum are not the cause of menstruation, the corpus luteum is important only in the preparation of the premenstrual hypertrophy of the endometrium. Novak believes also that the pituitary gland has a periodicity in function and this regulates menstruation.

Johnstone, however, suggests that the activity of the anterior lobe of the pituitary body is maintained by stimuli of a hormone formed by the trophoblasts of the ovum and that existence of this trophoblast in the uterus depends on the function of the corpus luteum.

Zondek and Aschheim, in their experiments looking toward replacing the function of the ovary with other endocrine gland elements in the body, proved that the pituitary gland produces its effect only when the ovary is present and does not work in ovariectomized animals. They call it the motor of the ovary, for the pituitary transplanted on an ovary acted as a motor of the ovary, speeding up its activity. Smith and Engle have shown, from their experiments with the pituitary body, that ovulation is enormously accelerated. Corner denies that there is a specific sex hormone, as Frank declares, but believes that there is a distinct specific corpus luteum hormone.

When we consider that following the radiation of glands other than the ovaries menstruation takes place, we must think of radiation as a direct stimulating agent. We do know that the first reaction to irradiation is a hyperemia, with increased vascular effect in the local area treated. It remains to be proved, however, that this mechanical hyperemia does in some way burst the unripened graafian follicle and thereby set in motion the menstrual machinery. That direct radiation

on the ovary does cause a reaction in the theca with subsequent rupture of a graafian follicle and menstruation, we have seen experimentally, but the biologic reaction and the exact mechanism of it are still unexplained.

Evidently the cure of amenorrhea, as Johnstone suggests, has to do with the uterus, the ovary, and the pituitary. Sterility may often be due to a persistent corpus luteum or in the human being it may be due to the excessive action of the Type II pituitary hormone.

Naujoks believes that the resumption of ovarian activity following temporary cessation after x-ray treatment, is due to the ripening of the undamaged primordial follicles rather than to a restoration of slightly damaged follicles or a renewal of activity of the germinal epithelium. He says that the adult ripened follicle which controls the next menstruation is usually destroyed by x-rays, but the ovum may not be, and it then proceeds to ovulation with only partial x-ray destruction. It may be fertilized, but usually does not proceed to develop, and finally aborts. The later ripening follicles are less radiosensitive and, though slightly damaged at first, recuperate to go on to perfect fertilization and development.

As regards the effects of irradiation on the mother and on the oncoming progeny, there is much confusion and many conflicting explanations. Aside from creating a mild dysfunction, most workers agree that but little untoward reaction takes place in the mother. It is concerning the effect, however, on the unborn child or subsequent effect on future impregnations, and the effect on the future development of the child born following ovarian irradiation of the mother, that various conflicting hypotheses have been offered. It is true that irregularly formed, abnormally formed, and subsequently maldeveloped offspring have been seen following irradiation of the mother.

Döderlein states that the reports of deformities of progeny of radiated mothers have not been proved, and reports of 42 pregnancies constitute his proof that irradiated mothers can give birth to normal offspring years afterward.

Werner, too, reports on 24 such pregnancies, but says that the usual irradiation of the mother does not necessarily cause permanent amenorrhea, even when they are treated with large doses. This has also been shown by Beclere, Stern, myself and others. Such women may subsequently become pregnant, as reported by Schmitt, Nurenberg, Döderlein, Williamson, and myself.

Schmitt reports in detail the results of 22 cases of irradiated mothers for various conditions who subsequently have 39 pregnancies with no abnormal births. In the 8 women treated with stimulation x-rays, there were 17 pregnancies with 12 living normal children.

That workers with radiation elements may marry and produce normal children has been shown by Naujoks who reviewed the cases of 91 mothers having 129 children. Of these only 9 were abnormal, and for 4 of these children other than radiation reasons were found for the abnormalities. This leaves a percentage of abnormalities not exceeding that occurring in progeny of women never irradiated.

It is unfortunate that the fact that irradiated mice have produced abnormal progeny has been utilized as a basis for prohibiting radiation on human beings. Although Bagg in his work with mice has produced abnormal forms, Levine, working along the same lines, failed to substantiate Bagg's findings. Moreover, Krupski and Eisenberg, experimenting on white mice, showed that irradiation did not cause abnormalities unto the third generation. Martius, while granting that abnormal results do occur in animal experimentation, does not feel that we can apply these conclusions to human beings. Robinson, too, claims that irradiation of animal ovaries is not the same as irradiation of human ovaries and that ovarian irradiation is free from harm to offspring.

Whitehouse says that every form of abnormal ova and monstrosity can be produced from normal ovaries and spermatozoa by artificial interference with the environment.

From a statistical study of the literature, Murphy classifies the abnormalities in children of irradiated mothers and concludes that pregnancies in such cases should be interrupted in order to avoid the possibility of producing monstrosities. It must not be forgotten, however, that monstrosities have occurred in women who have never been radiated. Flaskamp states that practical experience and not conjectures should govern the question of whether or not to irradiate human ovaries. He notes that there is an absence of proper reporting of results in the experimental irradiation of ovaries, no distinction being made between the weak doses leading to temporary and permanent sterility, and he does not believe that all reported so-called child injuries are due to the effects of previous irradiation. The births of normal children following x-ray treatments have been reported in a large series of cases by Flatau, Werner, Döderlein, Krups, Rongy, and Rubin. Williamson reports the case of a normal full-term baby born of a mother irradiated while pregnant. Schiller reports the case of a woman, forty-five years of age, in whom a full-term normal pregnancy followed x-ray therapy for myoma, and concludes from this that x-rays in this case stimulated a normal endometrium, making it capable of supporting gestation, which is was not able to do before treatment.

Radiation during pregnancy, however, is a dangerous procedure and may lead to fetal abnormality and destruction.

In our series we had 100 patients and 16 normal healthy children were born of irradiated mothers.

As advised by Rubin, all extraneous factors which might be the causative agents in any specific case were ruled out before x-ray therapy was attempted. In fact, no patient is accepted for radiation who has not been examined and passed upon by a competent gynecologist.

All cases herewith reported have been treated with high voltage x-rays, with the following factors: 200 KV, 4 MA, 0.5 mm. copper and one mm. aluminum filter and had administered on the ovaries a dose of 10-12 per cent. Treatment was given over the right and left anterior and posterior ovarian areas with alternate doses about one week apart. Inasmuch as the endocrine glands are in some way correlated in their action with ovarian functions, patients in whom distinct glandular deficiency was present, were given additional stimulating radiation to the pituitary or thyroid areas and in severe cases to both, with the idea of assisting the ovarian reaction. The successful results of such irradiation, which have been shown by Dripp and Ford, make this method one of choice in glandular dysfunction with ovarian irregularity. In this series this additional irradiation was used successfully in several cases. Especially useful was it in patients to whom a primary ovarian stimulation series had been given, resulting in subsequent pregnancy but which pregnancy terminated in an abortion and recurrent amenorrhea. Direct irradiation in such a case resulted in restoration of menstruation. In patients in whom ovarian radiation resulted negatively, treatment of the pituitary or thyroid brought on menstruation.

There were 100 cases treated, 15 single, 85 married. The symptoms were:

Amenorrhea	82
Associated sterility	62
Irregular menstruation	3
Irregular menstruation with sterility	10

The amenorrhea in these patients varied from eleven months to three years.

The ages of those treated were:

Single, youngest seventeen years, oldest thirty-two years.
Married, youngest nineteen years, oldest forty-five years.
Most of these patients were in the age group of 24-28 and 30-33 years.

Results:

Single:	Treated	15	No result	6
	Menstruated	7	Unknown	2
Married:	Treated	85		
	Menstruated	55		
	Pregnancies	22		
	No result	25		
	Unknown	5		
Babies born:				
	Twins	1		
	Boys	5		
	Girls	9		
Had two or three pregnancies after treatment				4
Pregnant and aborted				3
Still pregnant				3

CONCLUSIONS

The biologic action of the ovary and its intimate connection with menstruation and the question of the control of associated endocrine glands, especially of the pituitary, is not as yet clearly understood.

For the correction of female functional disorders the x-rays have proved efficacious, either when applied to the ovary or pituitary gland or other glandular areas.

The reaction to radiation is not as yet clearly understood. Normal children have been born of irradiated mothers and when properly given, x-rays are neither harmful to the mother nor to the offspring from such irradiated mothers.

REFERENCES

(1) *Aschoff, L.:* Pathologie Anatomine, ed. 6, 1923, G. Fischer, Jena, Germany. (2) *Anspach, B. M.:* Gynecology, 1927, J. B. Lippincott Co., Philadelphia. (3) *Bagg, H.:* Am. J. Roentgenol. 16: No. 6, 1926. (4) *Beclere, A.:* J. de radiol. et d'électrol. 40: 1925. (5) *Borak, J.:* Strahlentherapie 21: 1926. (6) *Clark:* Quoted by Anspach. (7) *Collwell, H. A., and Russ, S.:* Radium, X-rays and Living Cells, 1924, G. Bell & Sons, London. (8) *Corner, G. W.:* Am. J. Physiol. 86: No. 1, 1928. (9) *Corner, G. W., and Allen, Wm.:* Am. J. Physiol. 88: No. 2, 1929. (10) *Dobrovalkaia, Z. N.:* Arch. de biol. 38: 1928. (11) *Döderlein:* Deutsche med. Wchnschr., No. 54, 1928. (12) *Dripp, D., and Ford, F. A.:* J. A. M. A. 91: 1928. (13) *Eden, T. W., and Lockyer, C.:* Textbook of Gynecology, Macmillan Co., New York. (14) *Engle, E. T.:* J. A. M. A. 93: July, 1929. (15) *Ewing, J.:* Am. J. Roentgenol. 21: No. 4, 1929. (16) *Flaskamp, W.:* Zentralbl. f. Gynäk., January, 1927. (17) *Flattau:* Reported by Martius. (18) *Frank, R. T.:* The Female Sex Hormone, G. T. Thomas Co., 1929. (19) *Frankel, M.:* Strahlentherapie 12: 1921. (20) *Howell, W. H.:* Textbook of Physiology, W. B. Saunders Co., Philadelphia. (21) *Hartman, Carl G.:* AM. J. OBST. & GYNEC. 19: 405, 1930. (22) *Hirsch, I. S.:* Radiology 7: 1926. (23) *Hofbauer, J. I.:* Proceedings German Gynäkological Society in Archives Gynäkologie Kongress Heft, 1922. (24) *Johnstone, K. W.:* AM. J. OBST. & GYNEC. 19: 167, 1930. (25) *Kaplan, Ira I.:* Surg., Gynec. & Obst. 50: February, 1930; AM. J. OBST. & GYNEC. 14: 40, 1927; ibid. 15: 658, 1928. (26) *Krupski, A. I., and Eisenberg, M. F.:* Strahlentherapie 21: 1928. (27) *Lacassagne, A., and Coutard, H.:* Gynéc. et obst. 12: 1923. (28) *Lenke, R.:* Index & Handbook of X-ray Therapy, Oxford University Press, 1927. (29) *Levine, M.:* Am. J. Roentgenol. 17: No. 5, 1927. (30) *Martius, H.:* Strahlentherapie 24: 1927. (31) *Murphy, D. P.:* Surg., Gynec. & Obst. 47: No. 2, 1929. (32) *Naujoks, H.:* Strahlentherapie 32: 1929; Ztschr. f. Geburtsh. u. Gynäk. 86: 1923. (33) *Nemenov, M.:* Strahlentherapie 24: 1928. (34) *Novak, E.:* J. A. M. A. 94: No. 12, 1930. (35) *Nurenberg, L.:* Strahlentherapie 24: 1927. (36) *Regaud, Cl.:* Biological Principles of Radiotherapy of Malignant Disease, Lecture in New York, June 19, 1924. (37) *Robinson, M. R.:* Am. J. Roentgenol. 18: 1927. (38) *Rongy, A. J.:* AM. J. OBST. & GYNEC. 7: 169, 1924. (39) *Rubin, I. C.:* AM. J. OBST. & GYNEC. 12: 76, 1926. (40) *Schiller, W.:* Wien. klin. Wchnschr. 37: 1924. (41) *Schinz, H. R.:* Strahlentherapie 15: 1923. (42) *Schmitt, H.:* Strahlentherapie 30: 1928. (43) *Seitz, L., and Wintz, H.:* Unsere Methode der Roentgen-Tiefentherapie und Ihre Erfolge, Urban & Schwarzenberg, Berlin, 1920. (44) *Smith, P. E., and Engle, E. T.:* Am. J. Anat. 40: No. 2, 1927. (45) *Snyder, L. H.:* Am. J. Roentgenol. 14: 1925. (46) *Stern, S.:* Amer. Jour. Obstet. & Diseases of Women & Children 7: 1915. (47) *Van Herwerden:* Quoted by Hartman. AM. J. OBST. & GYNEC. 19: 1930. (48) *Werner, P.:* Arch. f. Gynäk. 129: 1926; Abst. Surg. Gynec. & Obst., No. 5, May, 1927. (49) *Westerman, A.:* Zentralbl. f. Gynäk., No. 53, October, 1929. (50) *Whitehouse, Prof.:* Proceedings Royal Society of Medicine, London, December, 1929. (51) *Williamson, H.:* Personal communication to author. (52) *Zondek, B., and Aschheim, S.:* Arch. f. Gynäk. 130: No. 1, 1927.

55 EAST EIGHTY-SIXTH STREET.

THE ARSENIC CONTENT OF THE HUMAN PLACENTA FOLLOWING ARSPHENAMINE THERAPY

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IT IS generally recognized that the treatment of syphilis in the pregnant woman is singularly beneficial to the fetus. Thus, it is a common observation that patients with a four plus Wassermann reaction and other obvious stigmata of syphilis, give birth to nonsyphilitic infants following a course of therapy which would ordinarily be regarded as inadequate to affect the progress of the disease in adults. Moreover, it is the usual experience that such infants remain clinically and serologically free from congenital syphilis. While it seems probable that pregnancy itself exerts an ameliorating effect upon the signs and symptoms of maternal syphilis[1], it appears equally evident that this beneficial action is not always extended to the fetus, which frequently succumbs to the disease in utero unless the mother has been treated.

This striking contrast between the fate of the fetus in treated and in untreated mothers suggests that antenatal therapy may exert some specific action upon fetal tissues. Although the exact mechanism responsible for such an effect is not known, it has been suggested that the placenta may exert some protective function, that it may possess some vitalistic property of keeping the drug in greater concentration in the fetal circulation, and that on account of the marked vascularity of that organ, a greater and more direct action of the drug is exerted upon the spirochetes in the fetus and in the placenta. Unknown immunologic reactions on the part of the fetus have also been cited as possible explanations. In 1923 Underhill and Amatruda[2] injected pregnant rabbits intravenously with large doses of neo-arsphenamine and showed that twenty-four hours later a substantial quantity of arsenic was still present in the placenta, an amount almost equal to that stored in the maternal liver. These authors believe that their experiments offer a definite answer to the question under discussion, since their results show a storage of arsenic in the placental tissues. As is well known, however, conclusions drawn from experiments on the placentas of lower animals are not necessarily applicable to the human placenta, which differs decidedly in structure from that of the rabbit. Moreover, it may be noted that the amounts of drug administered by Underhill and Amatruda were five times the usual therapeutic dose for human beings.

The present study comprises arsenic determinations on 21 human placentas from patients who had been receiving prenatal arsphenamine therapy. After some 10 placentas had been analyzed, it was thought that the results would be more significant if the placentas were divided into fetal and maternal portions, and each portion analyzed for arsenic; in the last 11 placentas studied this procedure has been carried out by a technic to be described shortly.

METHODS

After the placenta had been washed to remove gross blood, arsenic determinations were made on 20 gram portions by the method of Gutzeit as described by Scott.[3] Control determinations on placentas of patients who had not received arsphenamine were made at frequent intervals and were always found negative. Furthermore, arsenic-free placental tissue, to which had been added known amounts of arsenous oxide, was used for standardization. In the 20 gram portions of placenta taken for this purpose, differences of 5 mmg. in the amounts of arsenous oxide added could easily be detected and it therefore seems probable that the results reported in this paper (mmg. per 100 grams of placenta) are accurate to within 20 mmg. It should be particularly noted that the findings are expressed in micro-milligrams (thousandths of a milligram) of arsenous oxide.

The separation of the maternal from the fetal portion of the placenta was accomplished by laying the washed placenta on a flat surface with the fetal aspect down and shaving the maternal surface with a long, sharp knife, care being taken to secure only a superficial layer of from 2 to 3 millimeters. We are aware that such a method of division represents only an approximation, and that what we designate as the maternal portion likewise contains a certain quantity of fetal elements. We believe, nevertheless, that if the layer removed is sufficiently thin, the bulk of it will consist of maternal tissue only.

RESULTS

The results of the study as shown in Tables I and II indicate that arsenic is retained by placental tissue as long as fifteen days after the last injection of arsphenamine. The amount present during the first three days is relatively large, ranging over 100 mmg. per 100 grams of placenta. Furthermore, it may be noted that a definite cumulative retention of arsenic is manifested, the duration of retention being in part a function of the number of weekly treatments. Thus, Case 1, in Table I, showed no placental arsenic eight days after a single injection, while Case 9, which had received six weekly treatments, showed 40 mmg., although fifteen days had elapsed between the last injection and delivery. Likewise, the findings listed in Table II leave little doubt that the retention of arsenic by the human placenta occurs

chiefly in the fetal portion. It will be observed, indeed, that the quantity of arsenic found in the fetal portion of the placenta is often three and four times greater than that present in the maternal part. When, furthermore, it is recalled that the method used for separating the two parts of the placenta does not preclude the presence of some fetal tissue in what we call the maternal part, it seems likely that the actual maternal tissue really contained even less arsenic than our figures indicate.

TABLE I.   SHOWING ARSENIC CONTENT OF PLACENTA AT VARYING INTERVALS AFTER ARSPHENAMINE THERAPY

CASE NO.	NO. WEEKLY TREATMENTS	DAYS BETWEEN LAST TREATMENT AND DELIVERY	DRUG	DOSAGE GRAMS	PLACENTAL ARSENIC MMG. PER 100 GM.
1	11	2	N*	0.6	160
2	5	4	N	0.3	120
3	9	5	A*	0.3	80
4	5	5	N	0.45	90
5	2	5	A	0.4	60
6	15	6	A	0.2	100
7	1	8	A	0.3	0
8	6	15	A	0.3	40
9	6	15	N	0.4	60
10	10	30+	A	0.3	0

*N = Neoarsphenamine, A = Arsphenamine.

TABLE II.   SHOWING THE DIFFERENCES BETWEEN THE ARSENIC CONTENTS OF FETAL AND MATERNAL PORTIONS OF PLACENTA AFTER ARSPHENAMINE THERAPY

CASE NO.	NO. WEEKLY TREATMENTS	DAYS BETWEEN LAST TREATMENT AND DELIVERY	DRUG	DOSAGE GRAMS	PLACENTAL ARSENIC MMG. PER 100 GRAMS	
					FETAL	MATERNAL
1	3	1	N*	0.6	150	80
2	1	1	A*	0.3	120	80
3	3	2	N	0.6	180	100
4	8	2	A	0.2	160	40
5	6	3	A	0.3	120	40
6	11	5	N	0.45	80	40
7	5	9	A	0.3	60	Trace
8	4	10	A	0.3	40	Trace
9	6	10	A	0.3	60	20
10	5	14	A	0.2	40	Trace
11	6	32	A	0.3	0	0

*N = Neoarsphenamine, A = Arsphenamine.

Analyses of the umbilical blood for arsenic in three cases of this series were negative, as were also determinations on the livers and kidneys of a stillborn fetus whose mother had recently had a single injection of arsphenamine.

COMMENT

Upon first consideration, the evidence thus far advanced affords a satisfying explanation of the beneficial effects of antenatal arsphenamine therapy upon the fetus. Certainly, the concentration of a truly

spirocheticidal substance in the chorionic tissues, by presenting a barrier to the spirochetes as well as by "feeding" infinitesimal amounts of the drug into the fetal circulation, would provide as complete a protection to the fetus as could be desired. The question at once arises, however, as to whether the arsenic retained by body tissues is therapeutically active—a query that some students of the subject would answer in the negative. Thus, Kolls and Youmans[4] believe that the appearance of arsenic in a particular tissue is not the best evidence that arsphenamine was deposited there, since it is possible that the original molecule may have undergone considerable change elsewhere in the body with the result that simpler products were liberated in the circulation to appear at some distant point. In this connection the experiments of Kolmer[5] seem particularly significant. He employed three sets of rats that had been infected with Trypanosoma equiperdum. Into the first group he injected suitable amounts of a saline emulsion made from the livers of rabbits which had received weekly injections of 0.03 gm. of arsphenamine for six weeks; into the second group no injections were made, while in the third group he treated the rats with arsphenamine containing the same amount of arsenic as the saline emulsion. In the first and second groups no spirocheticidal effect was observed, all of the rats dying in from five to seven days; in the third group, however, all of the animals survived. As Kolmer, himself, points out, experiments of this kind are not conclusive, but they nevertheless suggest that some of the arsenic stored by body tissues is therapeutically inactive.

That a portion of the retained arsenic, on the other hand, does not lose its therapeutic potency is attested by the investigations of Voegtlin and his associates. In an extensive series of studies these workers showed that the parasiticidal action of the arsenicals is governed by the rate of excretion of the arsenic from the body, those arsenicals which are slowly excreted possessing a high parasiticidal value and vice versa. In this connection, they further demonstrated that the trypanicidal action of arsphenamine could be greatly increased experimentally by ligating the ureters or bile duct, the usual avenues of excretion of the arsenicals. As a result of their studies, Voegtlin and his coworkers,[6, 7] regard the temporary retention of the drug by the tissues of the host as an essential requirement for the chemotherapeutic action of arsenicals. They conclude that the secret of the practical value of arsphenamine and its substitutes is to be found in the fact that these drugs per se are not toxic and are deposited in the tissues immediately after injection. The deposited drug is then gradually converted by means of oxidation into the pharmacologically active, trivalent "arsenoxide." This latter compound on account of its relatively slow and prolonged formation exerts its toxic effect upon the

parasites during a long period of time. When further oxidation takes place to pentavalent arsenic, this compound is rapidly excreted.

It seems probable then that the retention of arsenic by the fetal portion of the placenta may be an important factor in the successful antenatal treatment of syphilis, although sweeping implications would be hazardous, since a portion of the retained arsenic is probably not therapeutically active.

CONCLUSIONS

1. Following antenatal arsphenamine therapy, arsenic is retained by the human placenta over periods as long as fifteen days after the last treatment.

2. The duration of the retention is conditioned in part by the number of weekly injections the patient has had, a definite cumulative retention of arsenic being manifest.

3. The retention of arsenic by the human placenta occurs chiefly in the fetal portion, which often contains three or four times the quantity demonstrable in the maternal part.

4. The storage of arsenic by the human placenta, and particularly its greater concentration in the fetal part, may be an important factor in the beneficial action upon the fetus resulting from arsphenamine therapy.

It is a pleasure for the writer to thank Dr. Williams not only for suggesting this problem, but for his interest and help throughout the study.

REFERENCES

(1) *Moore, J. E.:* Bull. Johns Hopkins Hosp. 34: 89, 1923. (2) *Underhill, F. P., and Amatruda, F. G.:* J. A. M. A. 81: 2009, 1923. (3) *Scott, W. W.:* Standard Method of Chemical Analysis, D. Van Nostrand Co., New York, 1927. (4) *Kolls, A. C., and Youmans, J. B.:* Bull. Johns Hopkins Hosp. 34: 149, 1923. (5) *Kolmer, J. A.:* Principles and Practice of Chemotherapy, etc., W. B. Saunders Co., Philadelphia, 1926. (6) *Voegtlin, C., and Thompson, J. W.:* J. Pharmacol. & Exper. Therap. 20: 85, 1923. (7) *Voegtlin, C., Dyer, H. A., and Miller, D. W.:* J. Pharmacol. & Exper. Therap. 20: 129, 1923.

Bailey, V. K.: Dystocia Due to Complete Atresia of the Cervix Uteri. Clin. J. 57: 597, 1928.

The author reports a patient, aged thirty-three, with a history of two premature children delivered by forceps with great difficulty, neither one living. Twelve years previously an operation for prolapse had been performed and two and one-half years ago the cervix had been removed and treatment for some type of vaginal infection had been initiated. On her entry to the hospital a well-developed child was palpated abdominally. On vaginal examination no cervix could be made out, the upper portion of the vaginal vault was closed by heavy scar. The author elected to do a cesarean section and remove the uterus. The convalescence was uneventful. The atresic condition was due to a combination of postoperative cicatrization and a subsequent persistent low-grade infection.

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THE COORDINATION OF THE UTERUS IN LABOR*

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THE uterus during pregnancy and labor is generally considered as a whole anatomically and physiologically. In the literature, references are found showing that not infrequently the uterus manifests asymmetrical contractions and tonus states, contraction rings, and other conditions known as, "obliquity of the uterus," "asymmetry of the uterus in early pregnancy," and "placental site paralysis." One of us (Rudolph) has observed the above-named conditions and believes that the mechanism is due to the fact that the uterus anatomically and physiologically is fundamentally a bilateral organ, and in abnormal states may contract arhythmically or asymmetrically. In this paper we will present an argument supporting the theory that the uterus possesses a coordinating mechanism which coordinates the motor activity not only of its sagittal halves but also of its transverse segments or portions.

A review of the literature demonstrates that the uterus in pregnancy and labor may contract irregularly or partially, but no explanation of the mechanism involved is offered. DeLee[1] has observed an irregularity in the time of onset of contraction in different portions of the uterus, the contractions starting in one portion and apparently spreading over the remainder. Cazeaux and Tarnier[2] and Commandeur,[3] have reported that the contractions may be irregular and partial, only an angle of the fundus uteri contracting. Hodge[4] has seen irregular contractions of the fundus uteri, and occasionally at one of its angles. Leischman[5] has observed irregular action, in which the whole organ was not symmetrically contracted, and by palpation, the hand over the abdomen, could detect inequality on the surface of the contracting organ, which was associated with prolonged labor. Smith[6] has seen one lateral half of the uterus to contract while the other half was relaxed. Duncan[7] has written that before inversion of the uterus can occur, there must be irregular action of the fundus uteri associated with paralysis of the whole or part. Bar[8] and Kerr[9] both reported that spasmodic contractions at the orifices of the fallopian tubes caused them to make a diagnosis of ectopic gestation. Cameron and Webster[10] have also referred to spasmodic contractions at the orifices of the fallopian tubes. Duncan[11] has also cited the cases of Lougier and Campbell in which dilatation of one of the orifices of the fallopian tubes was found during labor and at postmortem examination. Jaschke[12] has suggested that "partial inversions" might be caused by traction or by relaxation of circumscribed portions of the uterine wall and contraction of the adjoining portions. Soleri[13] reported a case with a painful circumscribed tetany of the gravid uterus with premature detachment of the normally inserted placenta. Hysterectomy was done, and the uterus showed a tumor of the right horn which gradually disappeared under observation. He expressed the opinion that in a certain number of cases of abortion

the cause is not a sudden contraction of the whole uterus, but only of a section of its walls, and often of that section on which the placenta is inserted. Holmes[14] stated that paralysis of the placental site of Rokitansky is a distinct physiologic inertia of the placental site, which is approved by Veit, Kiwisch, and Barnes. Barnes[15] has suggested that the orbicular muscles of Ruysch, contracting concentrically, would lessen the area of the uterus and cast off the placenta. Rigby[16] has reported that when the uterus has been altered in point of form, due to irregular contractions of its fibers causing it to be pulled down unequally to one side, while it is quite relaxed on the other side, the position of the child may be seriously affected, for it will not present obliquely as regards its long axis, and become a case of malposition. Barnes,[15] DeLee,[17] Duncan,[11] Edgar,[18] Eden and Holland,[19] Galabin and Blacker,[20] Hodge,[4] Herman,[21] Leischman[5] and Reynolds[22] have cited lateral obliquity of the uterus as one of the causes of face presentation, but no explanation is offered for the mechanism of the obliquity of the uterus. Webster[23] states that malpresentations and malpositions are apt to be produced by obliquity of the uterus, since in these conditions the long axis of the uterus is not in line with the axis of the inlet. Wigand[24] states that, "the chief cause of faulty position of the child does not depend so much upon the child itself, as upon the deviation of the uterus from its natural elliptical or pyriform shape."

There are numerous references showing that the human uterus may contract asymmetrically in its sagittal halves and the more extensive literature on contraction rings, which we do not intend to discuss in this paper, shows that the human uterus may contract irregularly in its transverse segments or portions. One of us (Rudolph) has observed two cases of marked irregular or partial contractions associated with high-grade asymmetry or sacculation of the uterus which raised the question of the mechanism of this condition in his mind. The irregularity of the contractions and tonus observed can be briefly summarized as follows: during labor it was noted that each lateral half of the uterus assumed a different form. On palpation, the tonus or firmness of the uterus was different in each lateral half of the uterus and there was a difference in the time of onset of the contractions in each lateral half, with one lateral half contracting in a normal manner and the other either not contracting or only feebly. In one case the uterus was only asymmetrical during contractions, while in the other it was continuous.

CASE 1.—Mrs. G. B., twenty-four years of age. Primipara. History, physical and prenatal examinations were of no importance. Last menstruation February 14, 1928. Expected labor November 21, 1928. Pelvic diameters: interspinal 22; intercristal 27.5 cm.; bitrochanteric 32 cm.; Baudelocque 19 cm.; biischial 9 cm.; pubococcygeal 9 cm. Examination at about the thirty-sixth week of pregnancy and on November 8, 1928. Diagnosis O.L.A., height of the uterus 32 and 33 cm., respectively, and the presenting part low in the pelvic excavation.

Onset of uterine contractions on November 11, 1928, at 11:30 P.M.; pains irregular and weak until November 12, at 3:00 A.M., when the pains became more regular and strong, every five minutes, and the patient entered the Mount Sinai Hospital at 6:00 A.M., apparently in active labor with the pains every three to five minutes and moderate.

Examination at 11:30 A.M. Diagnosis O.L.A., floating head, no effacement, and dilatation 2 cm., with pains every three minutes and moderate. Fetal

heart tones *located in the left lower quadrant,* and absent in the lower right quadrant, 140 and good quality. It was noticed after the patient had entered the hospital that the upper left part of the uterus would balloon out, with each uterine contraction and appeared like a cyst, about 8 cm. *in diameter* (Fig. 1). On palpation during a pain, the ballooned-out area was soft and no contractions could be felt; the breech occupied the ballooned-out area, and was easily palpable, while the opposite part of the uterus was contracting normally and was firm during a pain. During the pains the uterus was displaced to the left and the right border of the uterus was close to the median line of the abdomen. This condition persisted all day with slight progress and was treated expectantly. During the intervals between the pains the uterus was symmetrical (Fig. 2).

At 9:00 P.M. the ballooning of the uterus became more marked during the pains.

Examination at 11:30 P.M. Every two to three minutes there were strong pains. Bag of waters intact. Presenting part minus 3 cm., cervix effaced, and dilatation 5 cm. With each pain the ballooned area became more marked. The uterus was displaced to the left, soft, and the breech easily palpable during a pain. At this

Fig. 1.—This figure is a diagram to show the cyst-like ballooning of the uterus which occurred during the pains in Case 1.

Fig. 2.—This figure is a diagram to show that the uterus in Fig. 1 became symmetrical during the intervals between the pains.

stage the problem arose as to the mechanism of this ballooning and a cesarean section was seriously considered on account of a possible rupture of the uterus through the "ballooned area."

On November 13, at 12:45 A.M., the bag of waters ruptured spontaneously during a pain, the uterus becoming symmetrical during the pains that followed. No more evidence of the ballooning area was observed and the uterus contracted during the subsequent labor pains as in a normal labor. A rectal examination was made at 12:50 A.M., the presenting part had descended into the pelvic excavation and was plus 2 cm., with dilatation of 9 cm. At 1:00 A.M., a rectal examination showed complete dilatation and retraction of the cervix, with pains every three minutes.

At 1:50 A.M., with the head beginning to crown, low forceps and episiotomy were done, and an easy delivery, with a normal third stage of labor, resulted.

The postpartum examination did not disclose any malformation of the uterus. Examination six weeks postpartum showed a normal uterus on bimanual examination.

CASE 2.—Mrs. M. C., twenty-one years of age. Primipara. History, physical and prenatal examinations were of no importance, except in the last trimester the

uterus was unusually tense. Last menstruation June 28, 1928. Expected labor April 5, 1929. Pelvic diameters: interspinal 23; intercristal 25; bitrochanteric 28; Baudeloeque 19; biischial 9; pubococcygeal 9. Examination at about the thirty-sixth week of pregnancy and on April 18. Diagnosis R.O.A., height of uterus 32 and 33.5 cm., respectively; the head was floating and by the Monroe-Kerr maneuver it could be pushed into the inlet with no overriding of the fetal head.

Apparent onset of labor on April 17, 1929, at 10:30 A.M., which stopped in about nine hours. On April 18, at 5:00 A.M., the pains began and the patient entered the Grant Hospital at 8:45 A.M. Until April 20, at about 1:00 A.M., the pains were very irregular, varying from slight to strong painful uterine contractions with no apparent effacement and dilatation. Diagnosis R.O.P., false labor due to uterine dysfunction, no effacement, and dilatation 1.5 cm., bag of waters intact, the head minus 3, and right lateral obliquity. On April 19, the contour of the uterus changed from a pyriform shape to a marked right lateral obliquity which persisted during

Fig. 3.—This is a roentgenogram of Case 2, which shows a right lateral obliquity which persisted during the pains and intervals for approximately forty-eight hours after which the uterus suddenly became symmetrical.

the pain and the interval. The left half of the uterus was contracting normally and approached the median line of the abdomen with firm tonus; the right half of the uterus during a pain was seen to be far to the right of the abdomen, soft, with feeble contractions. The back was easily palpable during the pains. On April 20, at 10:00 A.M., the obliquity persisted and a roentgen picture was taken (Fig. 3).

On April 21, at about 1:00 A.M., the pains became more regular, occurring at intervals of five to eight minutes, and strong. Examination at 2:45 A.M. Diagnosis O.D.T., complete effacement, and dilatation 5 cm., head plus 1 cm., uterus in the midline and symmetrical, and of equal tonus on both sides during the labor pains, bag of waters intact. At 11:30 A.M., a vaginal examination was made. Diagnosis O.D.T., sagittal suture between the left oblique and the transverse diameters, effacement complete, and dilatation 8 cm., head plus 2 cm., and the bag of waters intact. Mother in good condition and the fetal heart tones 140 and of good quality. At 11:40 A.M., the bag of waters ruptured spontaneously.

At 3:20 P.M., the head caused bulging of the perineum, and as the patient was beginning to show the strain of labor, a prophylactic forceps operation was done, in the usual manner, and the child was delivered in good condition at 3:57 P.M. Patient was returned to her room in a fair condition. Uterus well retracted and firm.

At 8:00 P.M., the patient developed a severe postpartum hemorrhage which necessitated uterine packing. Patient reacted well and was discharged from the hospital in good condition on the thirteenth day postpartum.

Shaw[25] reports a case that might be a bilateral ballooning of the fundus uteri, which occurred in a primipara, three months' pregnant, in whom a cystic tender swelling was discovered on the upper surface of the uterus and about the same size as the uterus. The swelling proved to be a thin-walled sac of the uterine wall, and its cavity communicated with the cavity of the uterus by an opening which admitted two fingers. Both the sac and uterine cavity were lined by fetal membranes and the fetus moved freely from one to the other. Bride[26] saw a similar case.

The preceding literature together with our observations of the normal and abnormal behavior of the uterus in pregnancy and labor have caused us to inquire into the coordinating mechanism of the uterus. This inquiry has led us to adopt the theory referred to in the first paragraph.

Since ontogeny recapitulates phylogeny, a comparative anatomic study of the mammalian uterus from the lowest mammalian, the Monotremes, to the highest mammalian, the Primates, will assist us in understanding the embryologic development of the uterus and will be seen to have a bearing on the problem. In the Monotremes, the uteri are not fused, and each opens into the urogenital sinus which opens into the cloaca. In the marsupials, the uteri are not fused, but just before reaching the urogenital sinus, the vaginae fuse and open almost immediately into the cloaca. In the Rodentia, the uteri are perfectly formed, each with a well-formed cervix, separated from each other, but open into a single vagina. In the Carnivora, the upper portion of the uterus is divided to form the cornua or horns, which are quite long, while the lower portions fuse into a single tube, the corpus uteri, with one cervix opening into a single vagina. In the Ruminantia, the same arrangement is found as in the Carnivora, except that the cornua or horns are much shorter.[27, 28] In the Primates, we find a complete fusion of the upper and the lower portions of the uterus, forming a single uterus with a cervix which opens into a single vagina. Fig. 4.

Embryologically all midline organs, except the urinary bladder have a bilateral origin. The human uterus is a midline organ, but has a bilateral origin. The epithelium of the uterus and genital tract comes from the two müllerian ducts, one being originally on each side of the body. The muscular and connective tissue elements of the uterus and
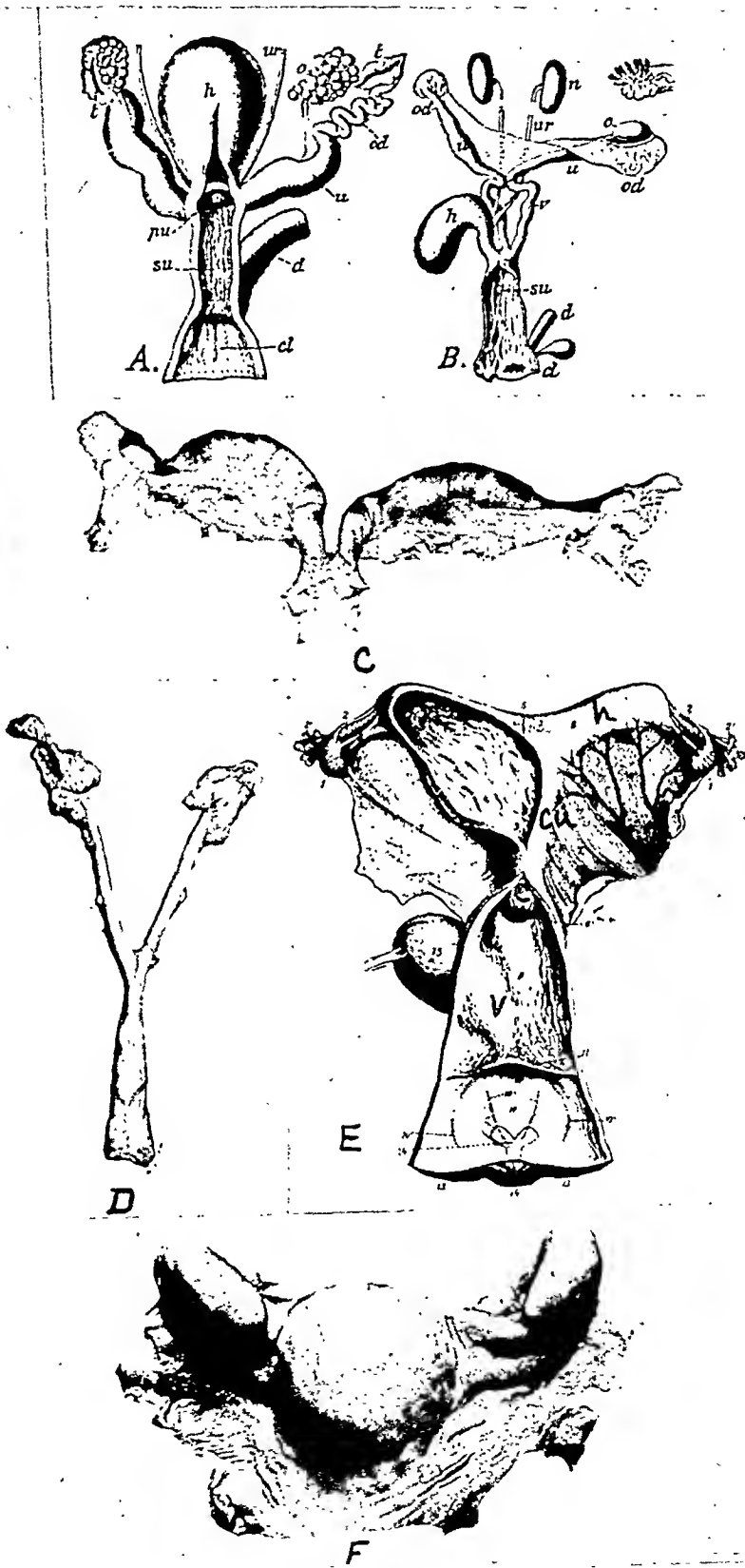
Fig. 4.

vagina come from the genital cord, which is formed by the fusion of the two urogenital folds, one from each side of the body.[29, 30, 31, 32]

The müllerian ducts begin to develop at the sixth week and arise from the outer surface of the wolffian ridge somewhat lateral and ventral to the wolffian duct. About the second month the müllerian and wolffian ducts begin to expand by invaginating the celom as a fold into the celomic cavity. This is called the urogenital fold and unites mesially with its mate on the opposite side. This fusion produces the genital cord which contains the two wolffian ducts, the two müllerian ducts, and mesenchymal elements to form muscle and connective tissue.

At about the third month fusion of the müllerian ducts occurs. After fusion has occurred, the mesial walls of the ducts disappear to form a single tube, the uterovaginal canal. Disappearance of the mesial walls of the ducts, first begins in the part that is to become the cervical portion of the uterus. The extent to which the urogenital folds and the müllerian ducts fuse varies in different animals,[29, 31] causing a greater or less degree of duplicity of the uterus. At about the fifth month the muscular walls of the uterus begin to differentiate from the mesenchymal tissue of the genital cord. Now the question of prime importance concerning the problem set out above is: Do the primitive muscle cells that come from the right urogenital fold give rise to the musculature of the right side of the uterus and those from the left give rise to the musculature of the left side of the uterus with some overlapping at the longitudinal axis; or do the primitive muscle cells from both mesenteries intermingle with and surround the müllerian ducts so that the musculature of the uterus cannot be said to be right and left sided in origin?

Embryologists do not express an opinion on this point, probably because it is of no special interest except as it bears on our problem. However, Bryce[31] and Felix in Keibel and Mall[29] state that defective fusion of the urogenital folds and the müllerian ducts explains certain malformations of the uterus seen in the human subject, but say nothing of the source of the musculature which, for example, surrounds each uterus in cases of uterus duplex in the human.

Fig. 4.—Diagrams and photographs depicting the comparative anatomy of the uterus.

A. The monotreme uterus (Eehidna aculeata). The uteri open into the urogenital sinus.

B. The marsupial uterus (Didelphys dorsigera). There is a "slight" fusion of the vaginae before opening into the urogenital sinus. *SU*, urogenital sinus; *V*, vagina; *U*, uterus. (From Kingsley, Hertwig's *Manual of Zoology*.)

C. The uterus of the rabbit, uterus duplex. The rabbit has a single vagina, but a uterus on each side opening separately into the vagina.

D. The uterus of the dog, uterus bicornis; *V*, vagina; *C*, cervix; *CU*, corpus uteri; *FS*, fundal sphincter; *H*, horn. The dog has a single vagina, a lower fused portion of the uterus (the cervix and corpus uteri), and an upper nonfused portion (the horns).

E. The uterus of the mare, uterus bicornis, but the horns are relatively shorter than in the dog. *V*, vagina; *C*, cervix; *CU*, corpus uteri; *H*, horn. (From Sisson, *The Anatomy of Domestic Animals*.)

F. The uterus of the monkey (M. Rhesus). (From photograph furnished by Dr. Carl Hartman.)

Let us examine the evidence bearing on the questions asked above. According to the precept that ontogeny repeats phylogeny, it is logical to assume that the human uterus has to some extent retained its primitive physiologic and anatomic characteristics. This assumption is supported by the fact that in the human female the various types of uteri from the uterus of the Rodentia (uterus duplex) to the uterus of the Primates occur occasionally, which is obviously believed to be due to the failure of fusion of the urogenital folds and the müllerian ducts in the human embryo. In these cases in which the müllerian ducts fail to fuse, each duct receives its complement of muscular tissue from the right and left urogenital mesentery or fold, which is shown by the fact that each uterus or horn in the uterus duplex or uterus bicornis of the human being contains muscle and connective tissue. It should also be pointed out in this connection that the blood and the nerve supply of the uterus is bilateral in origin.[33] It seems logical, therefore, to assume that anatomically the greater mass of the right uterine musculature comes from the right anlage and the left from the left anlage.

There are two other points of anatomic evidence bearing on this question. First, Hofbauer[34] in describing a specialized type of muscle in the human pregnant uterus, which he believes is analogous to the Purkinje or conductive system of the heart, finds a mesial band thinning out laterally on the anterior wall of the uterus, and two thin longitudinally arranged bundles on the posterior wall. He further describes what he has seen to occur in the uterus during cesarean section after the intramuscular injection of pituitrin as follows: "A pale band from two to three inches wide, composed of parallel fibers, is visible over the anterior surface of the uterus all the way from the bladder reflexion to the fundus, in its pattern resembling the tenia of the large intestine. The wave of contraction spreads from this band and involves an ever increasing area of the pregnant organ. Synchronous with the first appearance of the tenia in the midline, there comes into view an orbicular structure surrounding the insertion of the tubes, as well as a pale zone in the midline of the posterior aspect of the lower uterine segment. These phenomena are most striking when the operation is being performed in spinal anesthesia." We have observed tenia in the rabbit and to a less extent in the dog and they would probably be more evident under spinal anesthesia, since spinal cord section in the rabbit not infrequently increases the contractions of the uterus. Second, Freund[35] diagrams in the human uterus the overlapping of circular fibers in the midline suggesting the midline overlapping of the two right and left anlagen referred to above. This is indicated, also, in the gross dissections of the uterus and in the uterus arcuatus of early pregnancy.[36] In addition to the clinical evidence cited above, Jardine[37] cites a case along with one of Professor

M. Cameron's and one of his own in which after dilatation of the cervix had occurred, there was a distinct ledge felt about three inches above the external os involving only one side of the uterus, which suggests that even contraction rings may be unilateral in occurrence.

Quite recently Hartman, Koff and Ivy,[38] observing contractions of the uterus in the pregnant monkey at term, found that the uterine contractions start near the point of insertion of the tubes, and spread mesially and then downward over the lower portion of the uterus, and they further observed in one instance that a contraction started on one side and not on the other, which caused a temporary asymmetry of the uterus.

Several physiologic facts bear directly on this question. From the standpoint of comparative physiology, it is known that contractions *do not occur synchronously in both uteri in the rabbit nor in the two horns in the dog,*[39] and that in the rabbit the stimulation of the right sympathetic trunk, chiefly affects the right uterus. In the uterus of the dog, we have an example of incomplete fusion of the uterine anlage, the corpus uteri being the fused portion, and the horns the nonfused portion. Physiologically, we know that in labor in the dog[39] the two horns act for the most part independently, whereas the corpus uteri acts as a coordinated whole, but is directly correlated with the activity of the horns. In the dog, then, we have exemplified incoordinated activity of one portion of the uterus (the horns) and a coordinated activity in another portion (the corpus uteri) with reciprocal coordination between the two portions (the corpus uteri and horns). Therefore, fusion of bilateral parts normally leads to a physiologic coordination in motor activity which is manifested by the normal human uterus in labor and the corpus uteri of the dog. But this does not mean that the coordination is brought about by an intermingling of the primitive muscle cells from the right and left anlage, nor by a complete overlapping of the coordinating mechanism which arises from the two anlagen. Such a process does not occur in the embryologic development of the heart. In the heart there is an auricular coordinating structure, the S-A-nodal tissue, and a ventricular coordinating structure, the A-V-nodal tissue, with a coordinating mechanism existing between the two, which when it fails, leads to heart-block and causes a partial or complete dissociation of the activity of the auricles and ventricles. The analogy drawn here between the heart and uterus is not new, since Clark[40] has previously compared the uterus and heart. A complete overlapping of the coordinating mechanism does not occur even in the urinary bladder which is a midline organ and midline in origin. The urinary bladder when it contracts normally contracts equally in both longitudinal halves, but if the right nervus erigens (n. pelvicus) is stimulated, the right side of the bladder contracts which may be followed by a contraction of the

other side. Stimulation of the right hypogastric nerve also gives a contraction which is more or less unilateral. Stimulation of the right lumbar roots gives a bilateral contraction, because there is a certain amount of crossing of fibers in the inferior mesenteric ganglion.[41, 42] So, even in the development of the bladder with its midline origin there is a bilateral mechanism for contraction with a coordinating mechanism to unify the contraction of the sagittal halves. Further, when pregnancy occurs in the human female with uterus duplex or uterus bicornis, labor and parturition have occurred. By what mechanism does it occur in such uterine malformations in the human being? Is it not quite logical, or even obvious, that the mechanism of labor in the uterus duplex of the human being is the same as it is in the Rodentia, and that the mechanism in the human uterus bicornis is the same as it is in the Carnivora or Ruminantia?

No one who has carefully observed the activity of the human or primate uterus in labor can doubt the existence of some kind of a coordinating mechanism. And our description of labor in the dog[39] has shown that a coordinating mechanism is essential. The evidence cited above of a comparative anatomic and physiologic nature strongly indicates that in the development of the human uterus a midline fusion or connection between the right and left coordinating mechanisms occurs, and we believe it must occur in order to explain the type of contractions observed in the normal human composite uterus, in which both lateral segments normally contract synchronously.

Very little is known concerning the nature of the coordinating mechanism of the uterus. It may be nervous or neurogenic, muscular or myogenic, neuromuscular or analogous to the Purkinje tissue of the heart, or hormonic, or a combination of these. That the extrinsic nerves play a rôle in the activity of the human uterus in labor is generally recognized. With the present evidence at hand it is impossible to evaluate accurately the rôle they play in the human uterus, although according to Schafer, the nerves and ganglia undergo hypertrophy along with the uterine musculature in pregnancy. In the rabbit and dog they are known to modify the activity of the pregnant uterus. For example, it is well known in the rabbit that stimulation of the hypogastric nerve or plexus usually increases the activity of the uterus, but according to our observations[39] their section does not fundamentally interfere with labor; whereas in the dog we have been unable to demonstrate an effect on stimulating the extrinsic nerves of the uterus[39] but on section of the pelvic nerve, pregnancy is prolonged and in some cases incomplete because of disturbance in the activity of the vagina.[39] However, Goltz and Ewald[43] and others observed successful labor in a dog with complete destruction of the spinal cord below the lower thoracic segments which shows that the uterus is as fundamentally automatic in nature as the heart, stomach, bladder, and

rectum. The possibility of reflexes of a coordinating nature through the inferior mesenteric ganglion must be considered, but Kabierski and Heidenhain[44] and Masius[45] found that parturition occurred after section of the nerves to the uterus in dogs. A nervous reflex mechanism from the cervical ganglia must be considered, but Rein[46] removed the cervical ganglia in a dog which later gave birth to a litter, a fact which we have confirmed in two dogs (labor was abnormal in our dogs). Fleming[47] recently presented evidence of the existence of an intrinsic nervous mechanism in the uterus. He found a network of nerve fibers in the uterine wall, but no nerve cells comparable to those in the sympathetic ganglia. But he believes as a result of his histologic work and the action of drugs that there is "some arrangement for the control of tone and movement distributed at different levels." Although a hormone, or hormones, may be concerned in the initiation of labor, and are undoubtedly concerned in the uterine hypertrophy of pregnancy, it is unlikely that they are concerned in the causation of the coordinated activity of the uterus in labor. The most reasonable theory, then, of the nature of the coordinating mechanism is that it is either myogenic or neuromyogenic. The work of Hofbauer[34] supports the latter theory in that he finds histologic evidence of the existence of fibers in the uterus analogous to the Purkinje fibers of the heart.

EXPERIMENTAL

In a previous article[30] we have described a method for recording contractions of the postpartum uterus of the dog. By using this method it was found that most of the movements were initiated in the upper portion of the horn and traveled downward to the corpus uteri (in the absence of local irritation), or in other words, the contraction of the horns was usually followed by a contraction of the corpus. This type of polarity of the uterus has also been found to be present in the human vagina by Templeton, Stein and Schochet.[48] It occurred to us that by using this phenomenon, we might be able to study the coordinating mechanism of the uterus. We could by section separate the horns from the corpus and ascertain whether or not the polarity phenomenon persisted; and also excise the uterovaginal ganglia and ascertain whether or not the polarity phenomenon persisted.

METHOD

A balloon was placed in either one or both horns and in the corpus uteri of dogs from eighteen to seventy-two hours postpartum. The record of normal contractions was obtained; then each horn was separated from the corpus and a record obtained; and then the uterovaginal ganglia were excised and a record was obtained. In some experiments the ganglia were excised prior to the separation of the horns. The necessary operative work can be done without disturbing

the blood supply of the uterus. Experiments have been performed so far on seven dogs. It is not difficult to find and excise the ganglia, because they are markedly hypertrophied by pregnancy.

RESULTS

Our detailed observations will be published elsewhere, and will only be briefly summarized in this article.
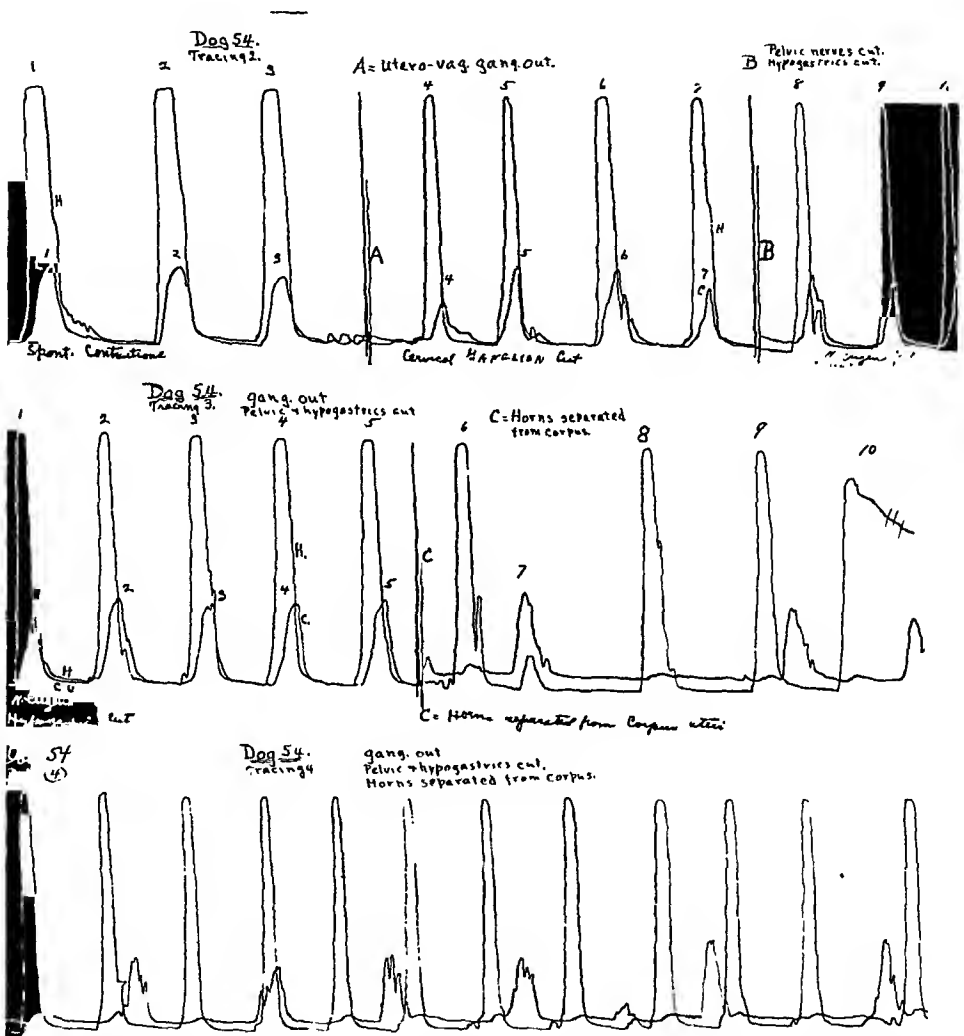
Fig. 5.—The figure shows the effect of first separating the horns from the corpus uteri, which caused no disturbance in correlated activity between horn and corpus, and then on removing the uterovaginal ganglia, which caused a dissociation of contractions of the horn and corpus uteri. (Dog 54.)

We found that when both horns contracted simultaneously, a single contraction of the corpus would follow. When one horn contracted and was then followed shortly by the contraction of the other, a summation, or superposition effect was manifested by the corpus. When one horn contracted and was then followed a minute or so later by the

contraction of the other, a double contraction of the corpus would result. In other words, the musculature of the corpus manifested the phenomenon of refractory period and summation, or superposition with reference to the propagated message or excitatory impulse.

Occasionally we observed a contraction to occur in, we will say, the left horn which would be followed by a contraction of the corpus, and then the region of the right fundal sphincter would contract which was followed by a contraction of the right horn, giving the appearance of a reversed contraction of the right horn.

As a rule when one horn was separated from the corpus, after a preliminary period during which coordinated activity or polarity was disturbed, the corpus would only contract after the remaining horn contracted, which indicated that the separated horn was no longer affecting the activity of the corpus.

When we separated the other horn from the corpus, after a preliminary period of irregular activity varying from five to thirty minutes, coordination between the separated horn and corpus would be reestablished. Now, on exision of the uterovaginal ganglia, the coordinated activity would disappear and would not reappear during a succeeding period of one hour. We have found that it is necessary to remove the ganglia completely. (Fig. 5.)

If the uterovaginal ganglia were first removed, disturbance of coordination would not result, provided care was exercised in removing the ganglia, but on separation of the horn from the corpus dissociation of horn and corpus resulted.

Hence, it is evident that the coordinated type of activity of the dog's uterus we have studied can be controlled by either of two mechanisms: one in the wall of the uterus and the other mediated by the uterovaginal ganglia; and that either mechanism in the absence of the other can carry on this coordinated activity of the dog's postpartum uterus.

Even after the removal of the ganglia and the separation of the horns, the uterus continues to contract, but there is no coordination of these contractions. However, the corpus is definitely affected by the removal of the uterovaginal ganglia. It becomes quite relaxed as a rule, its contractions are not as strong, and one observes frequently, which is shown on our tracings, irregular, feeble contractions of different muscle groups, resembling fibrillations. This observation is interesting in the light of Rucker's[49] report that sacral anesthesia causes marked relaxation of the lower uterine segment and an increase in the tone of the fundus. The obstetric literature on this point, however, is rather chaotic.[50-57]

SUMMARY OF EXPERIMENTS

These observations show that there is an intrinsic and an extrinsic coordinating mechanism in the dog's uterus and that one may sub-

serve, in part at least, the function of the other. In what layer of the
uterine wall most of the intrinsic coordinating mechanism lies has yet
to be determined.

DISCUSSION

A failure of the coordinating mechanism of the uterus, then, would
lead to dissociated irregular or partial contractions of the uterus de-
pending on the degree and portion of the coordinating mechanism af-
fected. A block of the coordinating mechanism between the right and
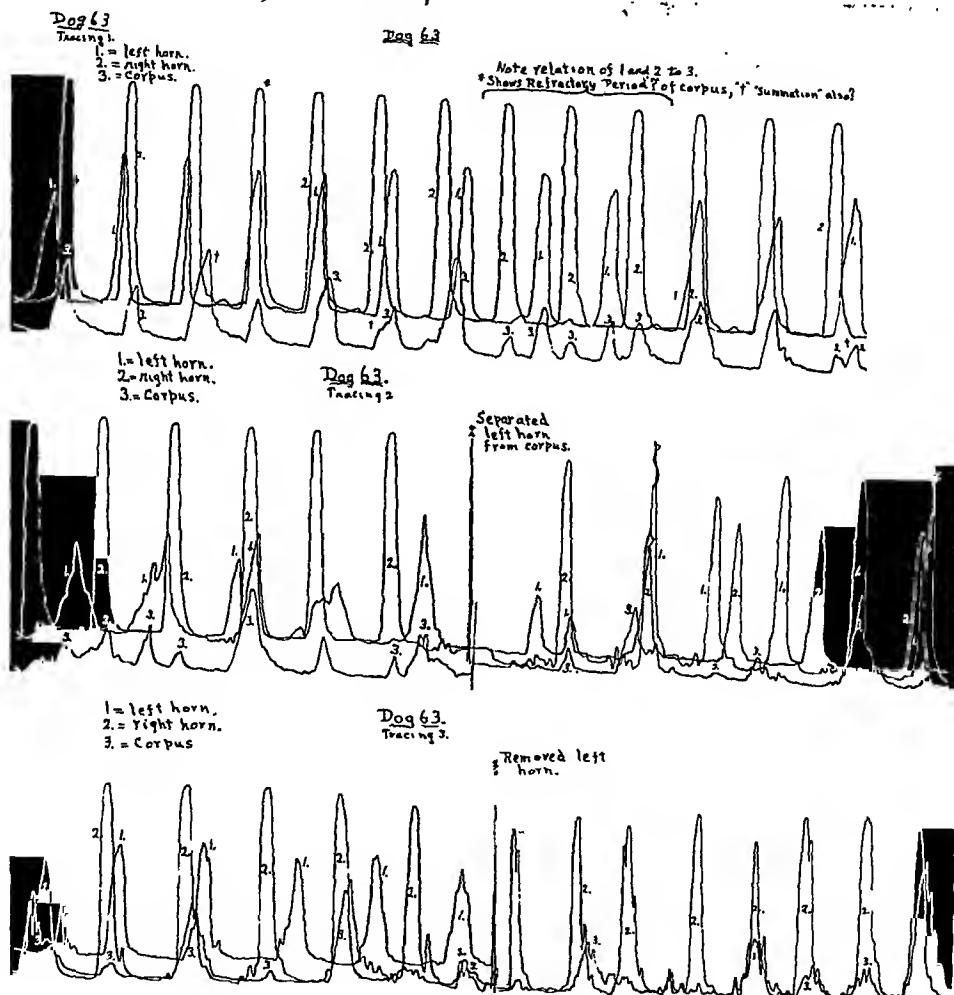
Fig. 6.—This figure shows several interesting features. Records of contractions were
made from both horns and the corpus uteri. In Tracing 1, it is to be noted that
when the two horns contracted together only one contraction of the corpus resulted;
when they contracted a little farther apart, the corpus a "notched" or double con-
traction; and when they contracted still farther apart, the corpus contracted just after
each contraction of the horn. The first part of Tracing 2 shows the same phenomena.
This demonstrates refractory period and summation or superposition. In Tracing 2,
the left horn was separated from the corpus, resulting in some disturbance of co-
ordination between left horn and corpus. In Tracing 3, the left horn was completely
removed from the body of the animal, and it is to be noted in this tracing and the
first part of Tracing 4 that right horn contracts in a coordinated manner with the
corpus. In Tracing 4 the right horn was separated from the corpus and a disturbance
of coordination resulted, which is not as marked as that which occurred in Tracing
6 and Tracing 7 after removal of the uterovaginal ganglia.

left halves would lead to an absence of a synchronous time of onset of the contraction in the two halves. A slow conduction in one-half compared to the other half would lead to more rapid contraction on the normal side with a slow spreading contraction on the affected side, similar to the cases described by DeLee and others referred to previously. An absence or a functional defect of the mechanism in one-half would cause an absence of contractions in that half, and give rise to the condition of, or a condition simulating obliquity of the uterus.
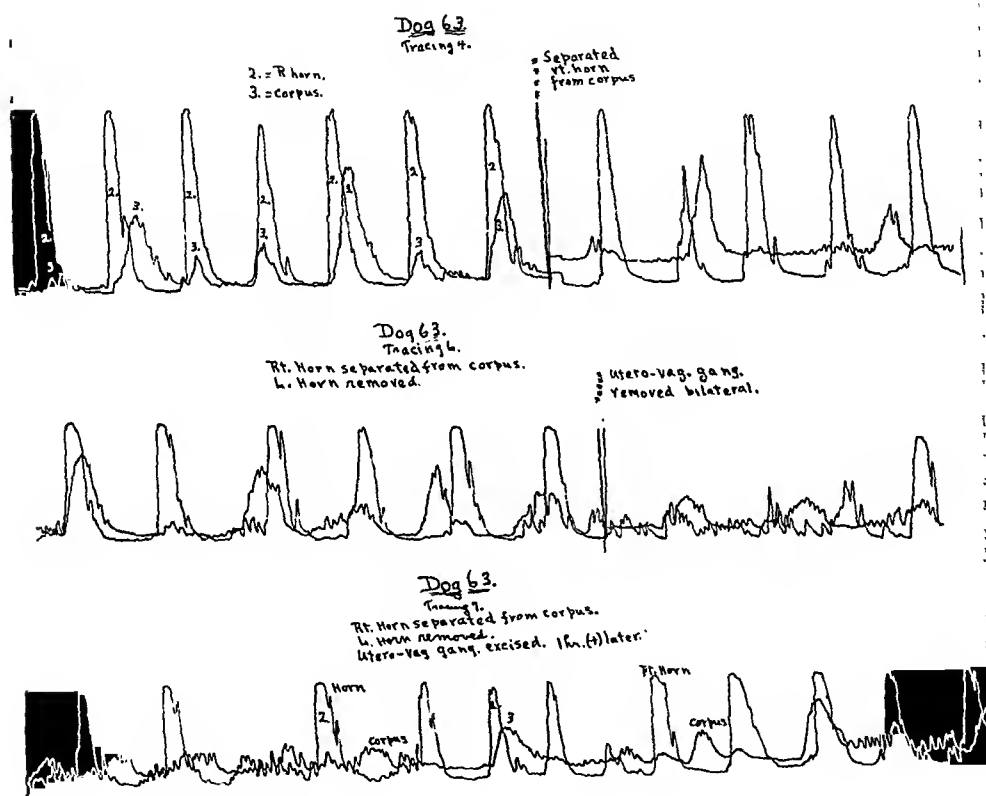
Fig. 6. Cont'd.

A failure of the coordinating mechanism in one-half, however, will not explain the asymmetry of the uterus in early pregnancy. DeLee[58] cites different types of asymmetry of the uterus in early pregnancy in which the musculature of one side manifests more hypertrophy than the other. This condition we believe is best explained by a defect in the musculature of the affected side which renders it slow in responding to the hormonal influence responsible for causing uterine hypertrophy. On the basis of the bilateral origin of the anlage of the uterine musculature such a defect (unilateral aplasia) is not unlikely and is comparable to some of the cases of uterus duplex or bicornis in which one uterus or horn has a greater complement of muscle than the other.

On the basis of a defect in the coordinating mechanism, the observed facts occurring in our Case 1 may be explained as follows: In this case there was in addition to the obliquity, a cyst-like ballooning of the upper left quadrant during pains with the result that during a contraction the breech moved up into the ballooned or noncontracting portion, and the head moved up and out of the pelvis; but on rupture of the membranes, the contractions of the uterus became normal and birth resulted. The cyst-like ballooning, we believe, was due to a greater degree of functional paralysis or paresis of the coordinating mechanism in the region of the uterus corresponding to the location of the orbicular muscles of Ruysch; and on rupture of the membranes, some factor operated to remove the functional defect. In Case 2, after a prolonged period of inertia, the contractions occurred synchronously on both sides, but were much stronger on one side than on the other, which caused an obliquity during contractions, but at a later period became of equal intensity on both sides. The fact that the contractions finally became symmetrical shows that there was no fundamental defect in the capacity of the muscle to contract. The factor causing the inertia must have affected the two halves of the uterus unequally, so that the side in which normal contractions recurred last, was the most affected, resulting in either defective conduction in the coordinating mechanism or a decreased irritability of the uterine musculature. The causative agent could not have primarily acted by way of the blood because then both halves of the uterus would have been equally affected.

Other types of asymmetrical contractions or dilatations of the uterus, such as those described by Bar,[8] DeLee,[17] Kerr,[9] Soleri[13] and others in which isolated contractions or dilatations occur at the uterine angles in the absence of an anatomic defect, and such as the various types of transverse contraction rings, can be explained as ectopic contractions or dilatations of the uterus, which may be analogous to the ectopic contractions that occur in the heart and to local circular spasms that are known to occur in the stomach, esophagus, and colon. On the basis of comparative anatomy and physiology we suggest that the so-called ''ring of Bandl'' is analogous to the fundal sphincters of the dog, which lie at the junction of the horn and corpus uteri.

Hofbauer[34] explains the condition of placental site paralysis or paresis by pointing out that hemorrhage may cause separation or dissociation of the fibers which he believes constitute the conducting and coordinating system of the uterus. He further points out that defective development of the specialized system he describes was observed in a specimen obtained from an elderly primipara in which inertia uteri occurred. In our two cases, however, the system must have been present but only temporarily functionally deranged, since normal contractions were observed to occur, which after they made their appearance resulted in the effacement and dilatation of the cervix in both cases.

Our previous observations on the dog and rabbit[39] show that the placental site is less active or motile than the remainder of the uterus which indicates that the placenta exercises in some way an inhibitory action on the local coordinating mechanism or muscle fibers. In the dog the placenta is only completely separated by a marked longitudinal contraction plus a circular contraction after the pup is born. This means that the expulsion of the fetus either releases the placental site from inhibition or sets up a more intense stimulation which breaks through the inhibition. The relative inertia of the placental site during uterine contractions is also true of the uterus of the monkey according to the observations of Hartman, Koff and Ivy.[38] (This discussion is not to be interpreted as depreciating the rôle that the retroplacental hematoma may play in the separation of the placenta.)

This paper has raised a number of questions—one that is of obvious particular interest is: In what percentage of cases do the uterine contractions occur asynchronously and asymmetrically in the two lateral halves of the uterus in the early period of the first stage of labor and may this factor play a rôle in determining the position of the presenting part?

SUMMARY

In this paper two cases of asymmetrical contractions of the uterus in labor are reported. These cases raised the question of the mechanism concerned. A review of the embryology, comparative anatomy, and physiology of the uterus shows that it has a bilateral origin and that the two halves except where fused act more or less independently. On fusion a correlating mechanism becomes manifest.

A type of coordinated activity manifested by the postpartum uterus of the dog has been studied. An extrinsic and intrinsic mechanism has been discovered, one resident in the uterine wall and the other in the uterovaginal ganglia, the former being the most important; and it has been found that the dog's uterine motor mechanism in situ manifests the phenomena of refractory period and "summation." On the basis of a functionally defective coordinating mechanism, the irregularity in the uterine motility, obliquity of the uterus, in the two cases observed, is explained and a basis for the explanation of other types of abnormal motor activity is offered.

REFERENCES

(1) *DeLee, J. B.:* The Principles and Practice of Obstetrics, ed. 4, p. 135, 1926, W. B. Saunders Co., Philadelphia. (2) *Cazeaux, P., and Tarnier, S.:* The Theory and Practice of Obstetrics, II. ed. 8, edited and revised by R. J. Hess, with appendix by P. F. Munde, 1886, P. Blakiston's Son and Co., Philadelphia. (3) *Commandeur, M. F.:* La Pratique de l'Art des Accouchements, I., 1914, Asselin et Houzeau, Paris. (4) *Hodge, H. L.:* Principles and Practice of Obstetrics, 1864, Blanchard and Lea, Philadelphia. (5) *Leischman, W. A.:* A System of Midwifery, 1879, Henry C. Lea, Philadelphia. (6) *Smith, W. T.:* A Course of Lectures on Obstetrics, 1858, Robert M. De Witt. (7) *Duncan, J. M.:* Mechanism of Natural and Morbid Parturition, 1875, Adam and Charles Black, Edinburgh.

(8) *Bar, P.:* Quoted by Kerr, Reference 9.   (9) *Kerr, J. M.:* Operative Midwifery, 1916, Bailliere, Tindall & Cox.   (10) *Cameron, J. C., and Webster, J. C.:* The Practice of Obstetrics by American Authors.   Edited by Charles Jewett, 1901. Lea Brothers and Co., New York and Philadelphia.   (11) *Duncan, J. M.:* Edinburgh M. J. 1: 1057, 1856.   (12) *v. Jaschke, R. T.:* Deutsch. med. Wchnschr. 4: 44, 1209, October, 1919.   (13) *Soleri, S.:* Clin. ostet. 30: 869, 1928; Abst., Surg. Gynec. Obst. 49: 1929; Int., abst., p. 234.   (14) *Holmes, R. W.:* Obstetrics, New York, vol. I, 1889.   (15) *Barnes, R., and Barnes, F.:* Obstetric Medicine and Surgery, 1864, Blanchard and Lea, Philadelphia.   (16) *Rigby, E. A.:* A System of Midwifery, 1841, Lea and Blanchard, Philadelphia.   (17) *DeLee, J. B.:* Reference 1, p. 622.   (18) *Edgar, J. C.:* Practice of Obstetrics, Revised by Norris W. Vaux, 1926, P. Blakiston's Son and Co., Philadelphia.   (19) *Eden, T. W., and Holland, E:* Text-book of Obstetrics, 1925, Macmillan Co., New York.   (20) *Galabin, A. L., and Blacker, G.:* The Practice of Midwifery, 1910, Macmillan Co., New York.   (21) *Herman, G. E.:* Difficult Labour, Revised by Carlton Oldfield, 1920, Cassell and Company, London.   (22) *Reynolds, E.:* American Text-book of Obstetrics, 1886, W. B. Saunders Co., Philadelphia.   (23) *Webster, J. C.:* A Text-book of Obstetrics, 1903, W. B. Saunders Co., Philadelphia.   (24) *Wigand:* Quoted by *Rigby.*[16]   (25) *Shaw, W. F.:* Lancet 1: 136, 1930; J. Obst. & Gynec. Brit. Emp. 37: 72, 1930.   (26) *Bride, J. W.:* Lancet 1: 136, 1930.   (27) *Hertwig, R.:* A Manual of Zoology. Translated by J. S. Kingsley, 1912, Henry Holt and Co., New York.   (28) *Wells, B. H.:* Am. J. Obst. 41: 317, 1900.   (29) *Keibel, F., and Mall, F. P.:* Manual of Human Embryology, 1910, J. B. Lippincott Co., Philadelphia and London.   (30) *Heisler, J. C.:* A Text-book of Embryology, 1910, W. B. Saunders Co., Philadelphia.   (31) *Bryce, T. H.:* Quain's Anatomy, vol. I, 1892, Longmans, Green and Co., London.   (32) *Arey, L. B.:* Developmental Anatomy, 1925, W. B. Saunders Co., Philadelphia.   (33) *Sampson, J. A.:* Surg., Gynec., Obst., May, 1914.   (34) *Hofbauer, J. I.:* J. A. M. A. 92: 540, Feb. 16, 1929.   (35) *Freund, R.:* Zur Lehre von den Blutgefaben normalen und kranken Gebarmutter, 1904, Gustav Fischer, Jena.   (36) *DeLee, J. B.:* Reference 1, p. 84.   (37) *Jardine, R. J.:* J. Obst. & Gynec. Brit. Emp. 20: 2, 1911.   (38) *Hartman, Koff, and Ivy:* Personal Communication.   (39) *Rudolph, L., and Ivy, A. C.:* Am. J. Obst. & Gynec. 19: 317-335, 1930.   (40) *Clarke, H. R.:* J. Obst. & Gynec. Brit. Emp. 20: 85-103, 1911.   (41) *Ivy, A. C.:* Personal Communication.   (42) *Schafer, E. A.:* Text-book of Physiology 2: 344, 1898, W. J. Pentland, Edinburgh and London.   (43) *Goltz and Ewald:* Arch. f. d. ges., Physiol. 62: 362, 1886.   (44) *Kabierski and Heidenhain:* Pfluger's Arch. 14: 527, 1877.   (45) *Masius:* Arch. de biol. 1: 696, 1880.   (46) *Rein:* Arch. d. f. ges. Physiol. 23: 68, 1880.   (47) *Fleming, A. M.:* J. Obst. & Gynec. Brit. Emp. 35: 247, 1928.   (48) *Templeton, Stein, and Schochet:* Proc. Inst. Med., Chicago 8: 80, 1930.   (49) *Rucker, M. P.:* Am. J. Obst. & Gynec. 9: 35, 1925.   (50) *Pitkin, G. P., and McCormack, F. C.:* Surg. Gynec. Obst. 47: 713, 1928.   (51) *Meeker, W. R., and Bonar, B. E.:* Surg. Gynec. Obst. 37: 816, 1928.   (52) *Oldham, S. P.:* Anesth. & Analg. 6: 192, 1927.   (53) *Metzger, M.:* Rev. franç. de gynéc. et d'obst. 24: 14, 1929.   (54) *Balard, P., and Mahon, R.:* Gynéc. et Obst. 19: 91, 1929.   (55) *Henry, J. R., and Jaur, L.:* Gynéc. et Obst. 19: 19, 1929.   (56) *Ducuing, J.:* Bull. Soc. d'obst. et de gynéc. 18: 179, 1929.   (57) *Audebert, J. L., and Esticny, E.:* Rev. franç. de gynéc. et d'obst. 24: 297, 1929.   (58) *DeLee, J. B.:* Reference 1, pp. 79 and 84.

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RHABDOMYOSARCOMA OF THE CORPUS UTERI

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INTRODUCTION

SARCOMAS of the uterus are quite infrequent. Altogether they comprise less than 1 per cent of all uterine tumors. The danger of sarcoma in a myomatous uterus is estimated by various authors, usually at from 0.6 to 1.8 per cent (see Schreiner,[1] Berreiter,[2] Evans,[3] Kuncz,[4] Imhaeuser[5]). They occur most commonly within the myometrium, and at times apparently within preexisting myomas (Albrecht[6]). Submucosal tumors are less frequent, and subserous ones are quite rare indeed.

Sarcomas of the uterus are usually composed of homologous tissue. There may be very immature and indifferent elements, the round or spindle cell sarcoma, or less immature and better differentiated cells, the fibro- or leiomyosarcoma, or mixtures of both in all possible combination. All these tumors have cellular prototypes in the normal constituents of the uterine wall. But tumors composed of tissue which is foreign to the uterus may also occur.

Heterologous tumors are less frequent than the homologous ones. Lahm[7] collected altogether 50 cases from the literature. They may be simple or complex, and either benign or malignant. Among the simple tumors, lipomas are most common, but chondromas, osteomas, myxomas, and neurofibromas also occur. The complex tumors may contain various combinations of these elements, together with smooth and striated muscle cells and glandular structures of all kinds (Frank[8]).

The heterologous tumors occur almost anywhere in the uterus, but are usually submucosal (Gerich[9]). This location is particularly characteristic of the mixed cell types, which appear almost always as polypoid masses hanging into the cavity of the uterus from a broad submucosal base. Intramurally, these tumors are rare, subserous ones even more infrequent (Schroeder[10]). Except for the lipomas which occur usually in the corpus, heterologous tumors elect the cervix much more frequently than they do the corpus uteri (Jones,[11] Wiener,[12] Gustav[13]). Gamper[14] collected from the literature, only 18 of them in the corpus uteri, and these were almost all submucosal, conforming to the type of sarcoma botryoides seen in the vagina in children and in the cervix in younger adults.

A few of the heterologous tumors of the uterus contain striated muscle. It was found in 18 of the 50 cases collected (Peterson[15]). It was present in only 6 of the corpus tumors reported (Shaw[16]). But

whenever striated muscle cells do appear in the uterus, they do so almost always in association with the complex, submucosal, botryoid forms (see Fels,[17] Reeb,[18] Glynn[19]). Rarely indeed do they appear as simple rhabdomyomas or rhabdomyosarcomas.

The following case is reported because it multiplied rarity of circumstance in that a heterologous tumor composed of malignant, embryonic striated muscle cells, was found unassociated with other sarcomatous elements, located in the corpus rather than in the cervix, in the subserosa rather than in the submucosa, and had apparently started in a preexisting myoma.

CASE REPORT

A white woman, fifty-two years old, with no history of any menstrual disturbance. The menses had begun at sixteen. She had borne two, normal, full-term children. The menopause had occurred at thirty years, and there had been no bleeding since.

Twelve years ago she had had an attack of pain in the lower abdomen, and was then told by a physician that she had a ''fibroid'' tumor in the pelvis. It bothered her no more, however, until just two months before her admission, when she began to suffer again from dull pains in the lower abdomen. She complained also of nausea and a marked weakness, and lost rapidly in weight.

After a short rest she felt better and was up and around until two weeks before entrance when the pains recurred. She began to feel feverish and took to bed. In the last week, she had become delirious.

Physical Examination.—She was markedly emaciated. She lay in bed acutely ill, semicomatose and in muttering delirium. Her temperature was 102°, her respiratory rate 36, her pulse 160. Heart and lung findings were negative. In the abdomen, a grapefruit-sized mass was felt rising high above the symphysis. It was soft, round, regular, somewhat tender to palpation and immobile. It filled the pelvis, and obliterated the vaginal fornices. A definite corpus uteri could not be distinguished in the mass. The cervix could not be palpated. Speculum examination showed nothing. She died in less than 24 hours after entrance into the hospital.

Clinical Diagnosis was.—Carcinoma of the corpus uteri, with inflammation, degeneration or pyometra, or degenerating fibromyoma.

Abstract of Necropsy Findings.—There was a focal bronchopneumonia in both lower pulmonary lobes with hypostasis, and a septic softening of the spleen. There were also a brown atrophy and parenchymatous degeneration of the myocardium and liver, a nodose goiter and a slight arteriosclerosis of the kidneys. The essential pathologic findings, however, were in the pelvic organs.

The uterus was transformed into a large, globular, irregular mass 18 × 14 × 8.5 cm. in diameter. The vaginal fornices were obliterated. The cervix was elongated and compressed and opened abruptly into the apex of the narrow vaginal vault. From the external os hung a narrow, pedunculated polyp 9 mm. in diameter. Its stalk was 1.5 cm. long and 3 mm. in diameter. Surfaces made by section revealed the cavum uteri to be compressed into the right lateral portion of the large, uterine mass. The cavum was 9 cm. long, 3 cm. in anteroposterior and only 1 cm. in transverse diameter. Within it, hanging from the left cornu, there was a second, smaller, fibromyomatous polyp.

The large irregular mass described was 12.5 cm. in greatest diameter. It was incorporated within the left lateral wall of the uterus, and had expanded it. Centrally it was homogeneously purplish-red. Toward the periphery it was more edematous and yellowish-grey. Between this large, intramural mass and the left

ovary, another, more boggy mass, 8 cm. in diameter, was interposed. It arose subserously from the left cornu. It was quite friable. Surfaces made by section were centrally purplish-red, peripherally were mottled with pearly-white areas, dull reddish-grey and yellowish mucoid ones.

The left fallopian tube stretched anteriorly over the crest of this mass for a length of 12 cm. to reach its ovary. The left ovary was edematous, soft and swollen to 6 × 4 × 3 cm. in diameter. The right fallopian tube was grossly normal. The right ovary contained several small and a few larger cysts up to 15 mm. in diameter, filled by clear fluid.

Microscopic Examination.—Sections from the pearly-white areas in the subserous node showed a marked cellular pleomorphism, but cells of elongated shape. predominated. The latter cells were sometimes drawn out into long bands. There were also many huge, round or oval cells. In all, the nuclei were either single or multiple, of irregular shape, and rich in chromatin. The chromatin usually formed coarse granules, and there were one or two large, round nucleoli.

In the huge cells, the cytoplasm was deeply eosinophilic. It was often gathered in the center about the nucleus, and only protoplasmic, spider-like processes of it
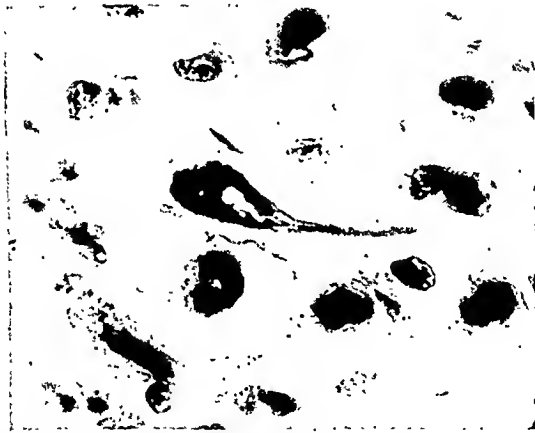
Fig. 1.—Well differentiated cross striation in the elongated cell in the center of the field. Scattered centriole granules and abortive fibril formation in the other cells. Mallory's phosphotungstic acid hemotoxylin. ×1200.

extended to the cell membrane in the periphery. The remaining part of these cells appeared empty, and vacuolated. They sometimes contained hyaline droplets which stained bright red with eosin, and orange red or deep blue with Mallory's phosphotungstic acid hemotoxylin. In the band shaped cells, one end was frequently thickened, club shaped, and contained the nucleus. In others, a long nucleus extended through the entire length of the cell; in still others several nuclei were crowded together.

With Mallory's phosphotungstic acid hemotoxylin, fine deeply staining purplish-blue granules of varying size, and clusters of these granules were seen in many of the cells, quite close to the nucleus. In others they were found scattered throughout the cytoplasm, and even in the protoplasmic spider-like processes. From many of the scattered granules, a tapering fibril extended in both directions. The granulated fibrils usually appeared singly and in no orderly arrangement. Occasionally they were lined up in small bundles, in the cytoplasm, or in the form of fine, longitudinal fibrils. After long searching, a distinct cross striation could be detected in a few of the cells. A sarcolemma was absent, or when present was poorly defined.

Between the cells were found fine fibrils of collagenous tissue. There were many capillary blood vessels which were often filled by a fine net of fibrin. Large vessels contained more compact, hyaline masses of fibrin. The greater part of the tumor was completely necrotic, so that no structure at all could be defined.

Sections from the intramural mass showed only the structure of a simple fibromyoma with advanced degenerative changes, hemorrhages and necrosis, but no evidence of malignancy.

Anatomic Diagnosis was.—Very immature rhabdomyosarcoma of the uterus, originating subserously from the left cornu; intramural fibromyoma in the left lateral wall of the uterus with red degeneration; displacement of the corpus uteri, compression of the cavum uteri and elongation of the left fallopian tube by the intramural fibromyoma; pedunculated fibromyomatous polyps of the corpus and cervix uteri, and serous and follicular cysts of the right ovary, and edematous swelling of the left.

DISCUSSION

The rhabdomyosarcoma was found associated with multiple fibromyomas. Leiomyosarcomas have been frequently reported in such association. The same uterus may contain a myoma and a sarcoma which are entirely independent of each other (Newell[20]). A sarcoma may develop just outside a myoma, invade and completely destroy it. More frequently, however, a sarcoma may develop within a myoma, and completely replace its benign predecessor (Dannreuther[21]). In 46 cases of leiomyosarcoma of the uterus, Frankl[22] found 22 developing on the basis of a myoma. On the other hand, one can never be sure in these cases that the compound tumor had not begun as a sarcoma which subsequently slowed down in certain parts to differentiate mature smooth muscle elements. Sage,[23] von Kuettner,[24] Ulesco-Stroganowa[25] and others hold that sarcomas frequently begin in preexisting myomas. Ewing[26] admits that they may do so, but believes that most of them are malignant from the first. A preexistent myoma may be indicated by:

1. Definite encapsulation of the tumor.
2. Retention of old calcified portions of myoma in the periphery of the mass.
3. Presence of other fibromyomas.
4. History of old fibromyomas.
5. Marked change of shape of the uterus, distortion of its cavity and hypertrophy of its walls, just as these appear in any simple fibromyoma of large dimensions and long existence (Kaufmann[27]).

Most of the heterologous tumors of the uterus do not arise in association with myomas, but exceptionally they may do so (Ritter[28]). The tumor in my case was definitely encapsulated. Yet a slowly, expansively growing tumor may too assume a sort of capsule. There were no calcified remnants of an old fibromyoma present, but most of the sarcomatous mass had undergone such necrotic changes that it was impossible to discern what had been there before. Even could mature fibromyomatous tissue be demonstrated directly within the malignant node, it would still be possible for it to have developed to-

gether with, or after the sarcomatous elements, but at a slower tempo.

The possibility that the subserous, sarcomatous mass was a recent and independent development cannot be precluded. But there was a definite history of multiple, large fibromyomas known to have been present for at least twelve years. There were other fibromyomas present, and these had undergone red degeneration and necrotic changes similar to those of the sarcomatous mass. The uterus showed the hypertrophic changes and distortion which comes with large, long-standing tumors. It is certain that multiple fibromyomas had long been present in this uterus. It is at least likely that the rhabdomyosarcoma had begun in one of them.

That a striated muscle tumor should appear in the uterus, indeed in a myoma uteri, is odd. Orthotopic rhabdomyomas occur in the heart, in skeletal muscle, in the tongue, wherever striated muscle cells are ordinarily present (Dewey[29]). In the uterus, striated muscle cells are not normally present. Yet in it, rhabdomyomas may occur. In fact, it is the more frequent site for ectopic rhabdomyomas.

Marchand[30] and Ribbert[13] maintained that they arose here, by metaplasia from the smooth muscle cells. It is not conceived that mature smooth muscle elements can degenerate into neoplastic striated muscle cells; one should therefore not speak of a sarcomatous degeneration. But among the differentiated cells of almost every tissue, there are rests of very immature, homologous and indifferent cells. These are available as sources for constant replacement, for regeneration after injury, and according to Cohnheim[32] for the proliferation of tumors. It is from such immature cells that myomas develop and from the remaining, still more immature but latent rests that a homologous sarcoma of any kind may secondarily, in abruptly faster tempo, develop within a myoma. It is then held that these very immature anlages of smooth muscle cells can alter their usual course of differentiation and produce striated muscle tumors.

Metaplasia can account for the development of smooth muscle, cartilage and even bone from a mesenchymal stroma. But it is quite unlikely that such a process can account for the production of striated muscle fibers, and particularly for a neoplastic proliferation thereof (Gamper,[14] Hauser,[33] Gordon[34]). In embryonic origin, smooth muscle and striated muscle are derived from sources too widely separated, for one type to transform itself into the other. Smooth muscle is derived from indifferent mesenchyme syncitium, striated muscle from the mesodermal somites. Much of the difficulty has arisen from the resemblance of undifferentiated striated muscle cells to smooth muscle cells. They may be growing side by side. But, they belong to different groups and the apparent transitions between the two are only due to the difficulty in distinguishing the younger forms.

Most investigators at present (Kolisko, Kehrer[35]) deny this metaplasia, but attribute the heterotopic striated muscle tumors to the

embryonic displacement of anlages of striated muscle cells. Similarly they ascribe the mixed tumors to displacements of embryonic mesoderm which can then differentiate both striated muscle cells and mesenchymal elements such as smooth muscle, cartilage, fat, elastic tissue, etc. That they are derived from teratomas, inclusios foetus, in which striated muscle cells predominate is denied, because true embryonic endodermal or ectodermal structures have never been satisfactorily demonstrated in them (see Mackenzie,[36] Cox,[37] Himwich[38]).

The genital tract has a very complicated development, and embryonic displacements can readily occur. The primary exeretory duct of this system, the wolffian duct, grows down from the thoracic segments. The müllerian ducts develop just laterally to them, then swing in under them from each side to reach and fuse in the midline to form the uterus and vagina. In the female, the wolffian ducts then disappear, or only vestigial remnants persist as Gärtner's ducts. But when these ducts are complete, they pass from the epoophoron through the broad ligament at first parallel to the fallopian tubes. Then they pass diagonally into the uterine substance approaching the mucosa and even extending in the lateral wall of the vagina to the hymen (Wilms,[39] Keibel and Mall,[40] Fischel[41]). This course of the wolffian duct marks the line of location of the heterologous tumors as they are found in the female uterus and adnexa.

It is therefore held that embryonic mesodermal cells from the myotomes of the dorsal region become attached to the wolffian duct, and are carried down with it in its caudal growth toward the vesicourethral anlage. They are dropped anywhere along its course in the adnexa, the corpus, the cervix, or the vagina. For years they remain dormant. In later life, under the stimulus of an infection, an irritation, adjacent tumors, constitutional predisposition, etc., these rests proliferate to form the heterologous tumors. From indifferent mesodermol round cells, a variety of mesenchymal structures may differentiate. From the myotome cells, striated muscle cells develop. But these stimuli would never produce the heterologous growths if the direct anlages of such cells were not already present (see Meyer,[42] McLean,[43] Barris[44]).

Striated muscle tissue has indeed been found incidentally in the uterus, even without tumor formation. Girode[45] and Nehrkorn[46] ran across islands of fully differentiated striated muscle cells in two uteri removed after puerperal sepsis. Nehrkorn found in his case evidence of an old perimetritis, Lahm[7] also found in adult uteri sheets of cells between the endo- and myometrium resembling embryonic striated muscle. Under pathologic irritation, these could well serve as the basis for the development of rhabdomyomatous tumors.

At various times, striated muscle cells have also been described as constituents of myomas. Ewing in fact accepts the ordinary myoma as resulting from an embryogenic disturbance in the development of

the uterus. Displaced striated muscle anlages are occasionally caught
up in them, and by subsequent proliferation produce rhabdomyomas
or even rhabdomyosarcomas within the preexisting myoma. But these
anlages and their tumors may just as well, however, appear independ-
ently or alone.

Not always in striated muscle tumors can cross striation be demon-
strated. The more immature the tumor, the more difficult is this to do.
It was only after long searching that an occasional cross striated fiber
could be found in this case. But the histologic diagnosis should be
suggested, and can be established without them. Attention was called
to the true nature of this tumor by the large cells with vesicular and
often multiple nuclei, centrally placed within the deeply eosinophilic,
finely granular, and often vacuolated cytoplasm which extended in
spider-like threads to the periphery of the cells. They resembled em-
bryonic myoblasts, and at times were fused into cell cylinders. The
granules about the nucleus were clusters of paired centrioles. These,
according to Wolbach,[47, 48] are scattered into the cytoplasm and ac-
quire short tapering fibrils at each end. Mallory's phosphotungstic
acid hemotoxylin demonstrates these structures best. The granulated
fibrils multiply rapidly and finally line up into fully differentiated
striated cells. But even in the absence of definite cross striation,
these tumors of myoblastic origin may be identified by the large cells
just described, and established by the presence of their centriole clus-
ters and abortive fibril formation.

The histologic distinction of a rhabdomyosarcoma from a leiomyo-
sarcoma and a fibrosarcoma is of more than academic importance.
Fibrosarcomas are extremely malignant, giving rise quickly to wide-
spread, massive, hematogenous metastases. Leiomyosarcomas are far
less malignant, and may be successfully extirpated with some prospect
of cure. Rhabdomyosarcomas are slow to metastasize but they will
recur promptly after an extirpation. They offer a grave prognosis
because of their rapid growth, extensive local infiltration, pressure
effects and degenerative changes (Halter,[49] Hamrick[50]). Death occurs
in these cases almost always in less than one and a half years after
the onset of symptoms.

The clinical distinction of rhabdomyosarcoma from other types of
sarcoma is impossible preoperatively, except for the submucous botry-
oid types which may be diagnosed from curettage specimens or from
spontaneously extruded necrotic pieces of tumor (cases of Sternberg,[51]
Bunten[52]). It is difficult enough to diagnose the development of any
sarcoma, particularly when it is associated with fibromyomas. In
these cases, the preoperative histories are almost identical with those
of ordinary fibromyoma cases. There is nothing in the history or
physical examination which makes it possible to suspect malignant
transformation until cachexia, anemia and emaciation announce an

irremediable state. These corpus sarcomas appear characteristically, however, after the menopause, when myomas should tend to regress. Should fibromyomas begin to enlarge after the menopause, should intractable pain independent of the menses appear, should loss of weight, anemia or a septic process become manifest, the diagnosis of sarcomatous transformation may at least be suggested.

SUMMARY AND CONCLUSIONS

A rare case of rhabdomyosarcoma of the corpus uteri is reported. It arose subserously, as a simple heterologous tumor, and apparently within a preexisting myoma. It developed from embryonic rests of striated muscle cells displaced in the course of the downgrowth of the wolffian duct.

These tumors may be identified histologically even in the absence of definitely cross striated cells. They present large cells with central nuclei, and deeply eosinophilic, often vacuolated cytoplasm which extends in spider-like processes toward the cell membrane. Centriole clusters can be found around the nucleus, and abortive, granulated fibril formation throughout the cells.

The distinction from a leiomyosarcoma and a fibrosarcoma is important because of the differences in degree and manifestation of malignancy. The clinical diagnosis is often obscured by the presence of preexistent fibromyomas, so that sarcomatous transformation is suspected only when it is irremediably far advanced.

REFERENCES

(1) *Schreiner, B. F.:* Surg. Gynec. Obst. 48: 730, 1929.   (2) *Berreiter, A.:* Zentralbl. f. Gynäk. 45: 1592, 1921.   (3) *Evans, N.:* Surg. Gynec. Obst. 30: 225, 1920.   (4) *Kuncz, A., and Zacher, P.:* Arch. f. Gynäk. 123: 211, 1924.   (5) *Imhaeuser, K.:* Arch. f. Gynäk. 123: 12, 1924.   (6) *Albrecht, H.:* Pathologische Anatomie und Klinik des Uterussarkoms. Biologie und Pathologie des Weibes, Halban & Seitz 4: p. 583, Berlin, 1928, Urban & Schwarzenberg.   (7) *Lahm, W.:* Heterologe Tumorbildungen des Muellerschen Ganges in Bereich der Cervix und der Corpus Uteri, Biologie und Pathologie des Weibes, Berlin, 1928, Halban & Schwarzenberg.   (8) *Frank, R. T.:* Gynecological and Obstetrical Pathology, New York, 1926, D. Appleton & Co.   (9) *Gerich, O.:* Zentralbl. f. Gynäk. 53: 2016, 1929.   (10) *Schroeder and Hillejahn:* Zentralbl. f. Gynäk. 38: 1920.   (11) *Jones, S. W. M.:* J. Obst. & Gynec. Brit. Emp. 35: 320, 1928.   (12) *Wiener, S.:* AM. J. OBST. & GYNEC. 8: 211, 1924.   (13) *Gustav, H.:* Centralbl. f. Gynäk. 50: 2194, 1926.   (14) *Gamper, A.:* Arch. f. Gynäk. 129: 878, 1929.   (15) *Peterson, A. J.:* J. Lab. & Clin. Med. 8: 369, 1923.   (16) *Shaw, W.:* J. Obst. & Gynec. Brit. Emp. 35: 498, 1928.   (17) *Fels, E:* Monatschr. f. Geburtsh. u. Gynäk. 78: 279, 1928.   (18) *Reeb and Oberling, C.:* Gynec. et Obst. 19: 81, 1929.   (19) *Glynn, E., and Bell, W.:* J. Obst. & Gynec., January, 1914.   (20) *Newell, F. U.:* AM. J. OBST. & GYNEC. 17: 191, 1929.   (21) *Dannreuther, W. B.:* J. A. M. A. 91: 1532, 1928.   (22) *Frankl, O.:* Arch. f. Gynäk. 122: 554, 1924.   (23) *Sage, E. C., and Miller, A. J.:* AM. J. OBST. & GYNEC. 16: 828, 1928.   (24) *von Kuettner, O.:* Monatschr. f. Geburtsh. u. Gynäk. 81: 177, 1925.   (25) *Ulesco-Stroganowa, K.:* Arch. f. Gynäk. 131: 34, 1927.   (26) *Ewing, J.:* Neoplastic Diseases, Philadelphia, 1928, W. B. Saunders Co.   (27) *Kaufmann, E.:* Pathology, Philadelphia, 1928, P. Blakiston's Son & Co.   (28) *Ritter, O.:* Ztsch. f. Geburtsh. u. Gynäk. 89: 266, 1925.   (29) *Dewey, K.:* Arch. f. Path. 3: 645, 1927.   (30) *Marchand, F.:* Virchow's Arch. 100: 42.   (31) *Ribbert, J.:* Virchow's Arch. 106: 282, 1886.   (32) *Cohnheim, J.:* Virchow's Arch. 65: 64, 1875.   (33) *Hauser, G.:* Virchow's

Arch. 88: 165, 1882. (34) *Gordon, W. H., and Feldman, M. S.:* Ann. Clin. Med. 3: 706, 1925. (35) *Kehrer, E.:* Monatschr. f. Geburtsh. u. Gynäk. 646, 1906. (36) *Mackenzie, D'. W., and Chase, W. H.:* Trans. Am. A. Genito-Urin. Surg. 20: 15, 1927. (37) *Cox, D. M., and Benischek, W. L.:* AM. J. OBST. & GYNEC. 16: 28, 1928. (38) *Himwich, H. E.:* J. Cancer Research 5: 227, 1920. (39) *Wilms:* Die Mischgeschwuelste der Vagina und Cervix, Leipzig, 1900, Georg Thieme. (40) *Keibel, F., and Mall, F.:* Manual of Human Embryology, Philadelphia, 1912, J. B. Lippincott Company. (41) *Fischel, A.:* Entwicklung des Menschen, Vienna, 1929, Julius Springer. (42) *Meyer, R.:* Ergebnisse der allgemeinen Pathologie (Lubarsch, Ostertag) 10: 643, 1905. (43) *McLean, S., and Wollstein, M.:* Am. J. Dis. Child. 26: 69, 1923. (44) *Barris, J., and Shaw, W.:* Proc. Roy. Soc. Med. 22: 32, 1929. (45) *Girode, J.:* Soc. Biol. 4: 121, 1892. (46) *Nehrkorn, A.:* Virchow's Arch. 151: 52, 1898. (47) *Wolbach, S. B.:* Arch. Path. 5: 775, 1928. (48) *Wolbach, S.:* Anatomical Record 37: 255, 1927. (49) *Halter, G.:* Zentralbl. f. Gynäk. 50: 2194, 1926. (50) *Hamrich, R. A.:* Prof. Staff Meet. Mayo Clin. 4: 5, 1929. (51) *Sternberg, C.:* Zentralbl. f. allg. Path. 46: 283, 1929. (52) *Bunten, J. C.:* Surg. Gynec. Obst. 41: 477, 1925.

KRUKENBERG TUMORS OF THE OVARY

WITH REPORT OF A CASE SECONDARY TO ADENOCARCINOMA OF THE JEJUNUM

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RECENT literature has contained reports of bilateral ovarian neoplasms containing both fibrous and epithelial elements which are usually found in association with malignant disease of the gastrointestinal tract. The relative rarity of these tumors, however, seems to justify the addition to the literature of this case of bilateral Krukenberg tumors associated with adenocarcinoma of the jejunum. The lesion was originally described by Friedrich Krukenberg in 1895 as a bilateral ovarian tumor of slow growth which caused general and somewhat symmetrical enlargement of the ovaries but preserved the regularity of their general contour. Krukenberg studied the histology in detail and called the tumor fibrosarcoma ovarii mucocellulare (carcinomatodes). Although there is some evidence that occasionally tumors of this type are primary in origin, the majority of cases are in association with carcinomas of the stomach and have been assumed to occur either by a direct implantation into the ovaries or by retrograde lymph flow.

Fallas, in reviewing the literature, has been able to collect 55 cases prior to 1918 and has added 23. The primary neoplasm has been, almost invariably, in the stomach. Ewing believes all of these tumors are secondary and that failure to find the primary growth does not mean that such lesions did not exist. Histologically, this tumor, originally called fibrosarcoma, is made up of a cellular fibromatous network dotted with large vesicular cells of the mucoid type, the nucleus

of which is often pressed against the cell boundary. This eccentric displacement of nucleus has given rise to the name "signet ring" cells, which are considered characteristic of the tumor. Certain tumors show large mucoid areas of softening as well as areas where the gland-like arrangement is well preserved. In other places (see Fig. 4) the adenoid arrangement has been practically lost and the appearance is that of a somewhat loose but richly cellular connective tissue network in which are scattered singly and in groups typical large bright cells, some of which are seen to be of the "signet ring" variety. As has been pointed out, it is generally admitted that these tumors are most commonly metastatic from scirrhous carcinomas of the stomach, and secondary carcinoma of the ovary metastatic from carcinoma of the jejunum, is extremely rare (Roblee).

CASE REPORT

The patient was a nurse aged forty-eight, para 0, white, weighing one hundred pounds, admitted January 12, 1929 to the medical service complaining of general malaise, loss of appetite, frequent vomiting, and severe pain in the lower left quadrant. These symptoms began November, 1928 and gradually increased in severity. Since then, nausea, vomiting, increasing pains in the lower left quadrant and in the rectum, and considerable distension of the abdomen have occurred with increasing frequency and severity. She gave a history of chronic constipation for years and was relieved only by oil enemas during the past fourteen weeks. She had lost thirty pounds in weight in the last year and had become anemic and weak.

Menstrual history was negative except that the intermenstrual periods had become longer during the past year and the flow less in amount. Physical examination showed a white, very nervous, thin woman in no great pain, pallid, with wrinkled skin. Mouth, teeth, heart, and lungs were normal. The abdomen showed considerable relaxation of abdominal wall and moderate distension of cecum and tenderness in the lower left quadrant. There were no adenopathies.

Pelvic examination was unsatisfactory because of senile retraction and of extreme tenderness in the vagina. There was considerable leucorrhea. Examination under anesthesia on June 15, 1929 revealed a senile atrophy of the vagina and cervix. The uterus was anterior and fixed. There was a large ovarian mass to the right and a similar, slightly elongated mass to the left which extended up along the left broad ligament region. These masses were only slightly movable. Rectal examination disclosed two to three small nodules one and one-half to two cm. in diameter in the rectovaginal wall. Proctoscopic examination was negative.

Laboratory Findings: Barium enema June 18, 1929 was negative. Urine was normal. Blood 8500 W.B.C. R.B.C. 3,300,000. Hb. 40 per cent. Blood smear showed anisocytosis and poikilocytosis and some polychromatophilia. Color index 0.6. Blood Wassermann negative. Blood grouping Jansky two. The patient was operated upon on June 21, 1929 after a transfusion of 500 c.c. of blood. A dilatation and curettage was done and a small amount of curettings was obtained. A low midline incision was made and the gall bladder was found enlarged but it emptied readily. There was a small nodule on the anterior surface of the liver one-half cm. in diameter. There was an annular, indurated mass about two cm. in length and almost surrounding the jejunum causing slight angulation. There was a hard nodule two cm. in diameter in the mesentery just internal to the main growth. Two nodules in the mesentery of the ileum were removed for section.

There were several nodules from one-half to one cm. in diameter along the left side of the sigmoid and descending colon. Stomach, spleen, and kidneys were normal. Pancreas was enlarged but not hard. There were large, hard, pelvic masses and
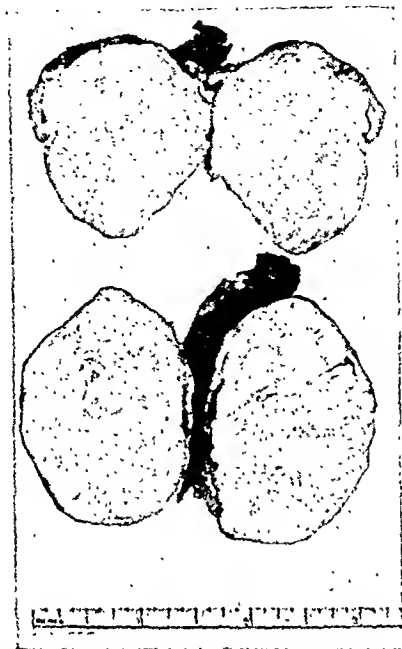
Fig. 1.—Gross appearance of bilateral ovarian tumors removed at operation. Note the symmetrical enlargement of the ovaries which maintain their characteristic outline although practically entirely replaced by neoplastic tissue.
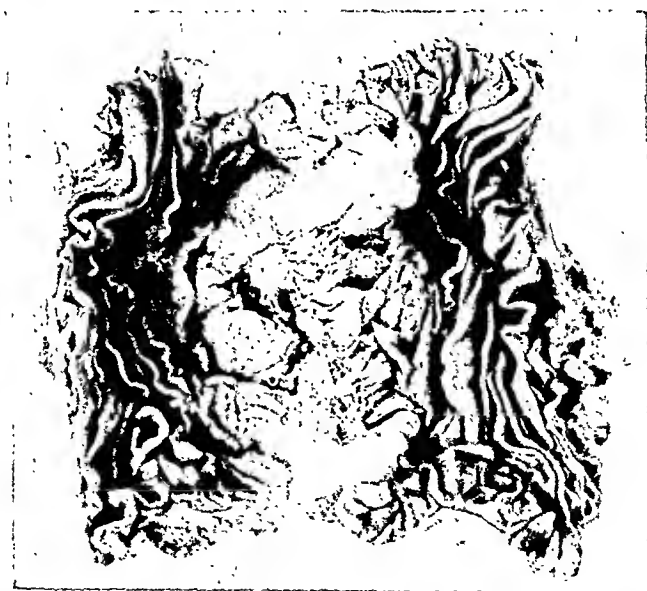
Fig. 2.—Segment of jejunum containing the presumably primary neoplasm. This specimen was obtained at the time of the operation for intestinal obstruction. There were large palpable metastases in the mesenteric glands and in the omentum.

the posterior culdesac contained many fine nodules from one-half to one cm. in diameter. Both tubes and both ovaries were removed after separating very dense adhesions. Lateral anastomosis and removal of the growth in the jejunum was

postponed because the condition of the patient was not good. Removal of ovarian growths was done to relieve severe pain in the lower left quadrant, and not because of any hope of cure.

The patient's postoperative recovery was good. Gastrointestinal x-ray series of July 5, 1929 showed the stomach low in position, pylorus spastic, duodenum normal. At six hours, the barium was in the jejunum and ileum, and there was some retention in the stomach. Twenty-four hours showed the barium in the small intestine with slight irregularity in the region of retention high in the abdomen. Examination
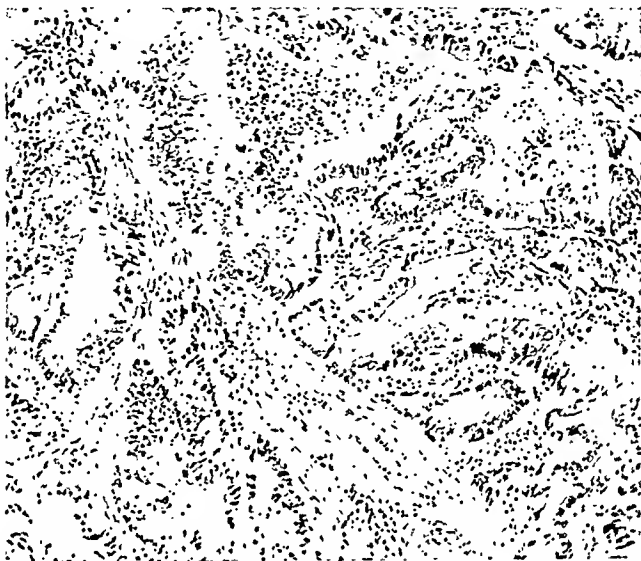
Fig. 3.—This is a section through the lesion of the jejunum. It is quite obviously an adenocarcinoma of the highest grade of malignancy.
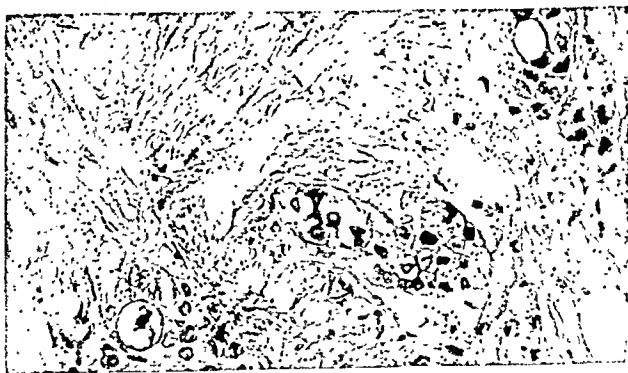
Fig. 4.—This section is taken from one of the ovaries and is identical in structure with other sections taken from various portions of these tumors. There is a typical connective tissue stroma in which are scattered the large mucoid cells characteristic of this tumor. Several typical "signet ring" cells are shown.

showed a fairly marked spasm in the lower portion of the stomach but no organic lesion in the stomach or duodenum. There was some barium retention remaining in the jejunum. On July 12, 1929 a secondary operation was performed to relieve partial obstruction. A left paramedial incision, extending from 2 inches below to 4 inches above the umbilicus was made. The annular carcinoma of the jejunum was excised. The free ends were invaginated and a lateral entero-anastomosis was performed. Abdominal examination was otherwise as before except the sig-

moidal mesentery was enlarged and adherent and contained a nodule the size of a walnut. The condition of the patient improved rapidly after operation, and she was discharged on Aug. 5, 1929 in fair general condition, barring some abdominal pain at irregular intervals. X-rays taken prior to discharge showed no bony metastases.

On Oct. 21, 1929 she was readmitted to the hospital complaining of severe pain in the abdomen, distention, vomiting, and a complete obstruction of the bowel. Examination showed a greatly emaciated white woman weighing about eighty-five pounds. The abdomen was considerably distended and tense. There was occasional peristaltic wave visible across the abdomen during which time the pain was accentuated. There was a tender, small nodule below the umbilicus in the midline in the abdominal wall which was slightly movable. There were a few hard inguinal glands. The extremities were markedly emaciated. The patient continued to have a great deal of pain somewhat relieved by morphia until she died on Nov. 12, 1929. The temperature remained normal throughout. X-ray plate of the spine, chest and femur on Oct. 21, 1929 showed a small rounded area at the level of the ninth rib dorsally, four inches from the midline, which might represent metastatic growth. Otherwise x-rays were negative.

Pathologic report: Carcinomatosis. Annular carcinoma of the jejunum with bilateral ovarian metastases. Metastases to the ileum, ureter, liver, peritoneum, mesenteric lymph nodes and wall of the bowel. Microscopic sections of many of the metastases showed well differentiated alveoli. The cells were distinctly outlined and varied between cuboidal and columnar in type, and the nuclei were small and hyperchromatic. Mitosis occur with a moderate degree of frequency. The stroma is abundant, is dense but often loose and cellular toward the edges. The lateral anastomosis was in good condition. The entire pelvis was full of peritoneal metastases which surrounded the gut.

DISCUSSION

This case is unusual in that primary carcinoma of the jejunum with typical Krukenberg secondary growths in the ovaries is very rare, although Roblee, in a recent article, described a case which had its primary adenocarcinoma in the jejunum with secondary growths in the ovaries. The "signet ring" cells and predominances of stroma in the ovarian tumors is very striking in this case. Several cases have been found where the primary tumor is in the sigmoid and cecum, one probably of the bone, but well over 90 per cent are primary in the stomach. Major reports two authentic apparently primary Krukenberg tumors of the ovaries. There are, as pointed out by Major in 1918, three possible ways of the dissemination of the tumor: (1) Retrograde metastases from the stomach and intestines through the lymphatics along the aorta and iliac vessels and by blockage of the lymph glands to the ovaries. (2) Peritoneal dissemination, it being well known that particles of coloring matter placed in the peritoneal cavity are picked up by the ovaries. (3) Blood stream metastases. Major reported a case of metastases into pulmonary blood vessels and into the lungs. In this case, metastases might have been from all three methods: the metastases in the mesentery of the jejunum, ileum, descending colon and sigmoid and a few retroperitoneal lymph nodes suggested dissemination through the lymph glands of the aorta as did

also the fact that the tumor in the ovary was growing apparently from within outward, the serosa being entirely free of tumor growth. These all suggest lymphatic dissemination. However, the presence of many nodules of tumor tissue in the culdesac suggest peritoneal dissemination, this being somewhat offset by the presence of similar nodules in the rectovaginal wall and also by their absence over the rest of the peritoneal surface. Metastatic growths in the omentum and the liver suggest dissemination by the blood stream although autopsy gave no further evidence in support of this.

Miller furnished strong evidence of lymphatic dissemination showing epithelial plugs in the lymph spaces and found, in the different sections, that one could have all stages from the alveolar formation to the breaking-up of these alveoli into irregular clusters of epithelial cells, these again being split into groups of two and three, and finally large signet cells appeared in the connective tissue. Marked variation in microscopic morphology occurs. Ewing suggests for these tumors an origin in the transformation of epithelial cells into spindle cells, as a source for the carcinosarcomatous structures. This, while explaining possibly those cases of authentic primary growths in the ovaries, can have no bearing upon this case.

Jarcho reports, in his cases, that after the tumor had once invaded the tubes and uterus, the posterior bladder wall was always infiltrated, advising against hysterectomy for this reason. Our case may not have reached this stage or perhaps the direction of metastases was not toward these organs for although the fimbria of the right tube showed a few nodules a few mm. in diameter, the rest of the tubes, uterus and bladder wall were free from tumor growth. The rather marked secondary anemia of the patient seemed to be due to inanition and gradual obstruction. The occurrence of almost complete postoperative intestinal obstruction by pressure on the bowel with the anastomosis in good condition from without, together with the occlusion of the left ureter in a mass of tumor tissue involving the rectum, ileum, uterus, ureter with the attendant hydronephrosis was striking.

REFERENCES

(1) *Amann, J.:* München. med. Wchnschr. 11: 2414, 1905. (2) *Chapman, T.:* Surg. Gynec. Obst. 31: 58, 1920. (3) *Fallas, R.:* Surg. Gynec. Obst. 49: 638, 1929. (4) *Jarcho, J.:* AM. J. OBST. & GYNEC. 13: 288, 1927. (5) *Krukenberg, F.:* Arch. f. Gynäk. 50: 287, 1896. (6) *Major, R.:* Surg. Gynec. Obst. 27: 195, 1918. (7) *Roblee, M.:* AM. J. OBST. & GYNEC. 18: 790, 1929.

TWIN PAPYRACEOUS FETUSES IN TRIPLET PREGNANCY, WITH REPORT OF A CASE

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THE production in utero of a mummified fetus is a well recognized but rare occurrence in association with missed abortion or multiple pregnancy. Mummification and flattening are found almost exclusively in the latter when one fetus dies at an early period and the other goes on to further development. Well characterized papyraceous fetuses are for the most part twins of normally developed, living infants.

The relative infrequency of triplet as compared with twin pregnancy would in itself diminish the incidence of fetal mummification in the former. The occurrence of twin papyraceous fetuses in triplet pregnancy is but briefly touched upon in some of the German books of reference[1,2] on obstetrics. A search of the available literature has disclosed only twenty mentioned instances. Because of the rarity of the condition and certain points of interest connected with it, a case recently encountered is reported here briefly, and the literature is reviewed to date.

LITERATURE

In a primipara in whom labor occurred at the seventh month, Pretty[3] discovered "some semisolid, movable substances covered with thin membrane," which on being removed proved to be mummified fetuses weighing 4 ounces and 7 ounces. The third child, weighing 3½ pounds, was born alive shortly thereafter. All three were males. There were two placentas, a single and a double one. This case was described before the Royal Medical and Surgical Society of London, and in the discussion a Mr. Ritter stated that Dr. Robert Lee had exhibited a similar one to him five years previously. Two fetuses were of four months' development, and the third alive at full term. He mentioned that Paul Portal had figured a similar case 160 years before.

Van Oteghem,[4] after attending a primipara at the normal delivery of a full-term male, removed the placenta from the vagina by slight traction, and found a portion of the membranes unusually adherent. While he waited, a uterine contraction expelled a formless mass which adhered by a few fibers to the membranes which had remained behind. It was a degenerated placenta, and with it were two flattened fetuses of between three and four months' development.

Lyle[5] reports very briefly the birth of a living eight months child, which was preceded by the expulsion of a blighted fetus that had died at the fourth month. In connection with the placenta there was another blighted fetus apparently of the same age as the first.

Reuss[6] had a case in which, after a full-term living child, two papyraceous fetuses nine centimeters long were born with the placenta.

At the seventh month in a primipara, Small[7] found projecting from the fully dilated cervix a loose body which was easily withdrawn and which proved to be a

papyraceous fetus of four months' development. The birth of a seven months' life-less fetus with its placenta shortly followed. Then came a second papyraceous fetus with a placenta to which the first one had also apparently been attached.

On the edge of the placenta which was expelled following the breech extraction of a full-term living child from a primipara, Gutman[8] found a gray mass made up of two papyraceous fetuses of four months' development and their degenerated placenta. They had a common chorion but separate amnions, and were single ovum twins. One umbilical cord had a marginal insertion, the other, a velamentous. The course of pregnancy had been normal.

Bazzanella[9] found a mummified fetus of three months development among the blood clots that were expelled with the placenta following the forceps delivery of a full-term living male in a primipara with hydramnios. The uterus contracted and retracted to the usual size, and there was no postpartum hemorrhage. Forty-eight hours later an atrophic placenta with a papyraceous fetus of the same size as the first was expelled.

Sänger[10] observed a delivery at the seventh month of one living and two papyraceous fetuses.

In the instance described by Lambinon,[11] a primipara gave birth normally to a full-term child. In the third stage the midwife found it necessary to interfere because of postpartum hemorrhage, and, after removing the normal placenta, she found that a second remained behind. This was strongly adherent, of a gray color, and of firm consistency, and with it she removed single ovum twin papyraceous fetuses of about three months' development. The cord of the living child had a velamentous insertion.

A midwife brought to Müller[12] some skull bones of a three to four months' fetus which had been expelled as part of an extremely offensive vaginal discharge. His examination of the patient showed an eight to nine months' pregnancy with the uterus irregularly enlarged. The region of the right cornu was higher than the left, and contained the breech. The left cornu was protuberant and hard. The cervix admitted two fingers, and contained membranes and bones. Half the skeleton of a three to four months' fetus having a very bad odor was extracted, and after two days labor occurred normally. The placenta showed in the hard, globular portion which had been palpable externally a second papyraceous fetus enclosed in membranes.

Aldridge[13] found presenting at the vulva in a primipara the foot and leg of a mummified male fetus. After its delivery, the presenting membranes were ruptured artificially, and a living eight and one-half months' female child was born. A second mummified male fetus of four months' development was then expelled. Some difficulty was experienced in removing the placentas. To one of these the two male fetuses were attached while the other belonged to the living female. Aldridge regarded the mummified fetuses as single ovum twins.

The sequence of events was almost identical in the case reported by Nolte.[14] One papyraceous fetus preceded and one followed the spontaneous delivery of a full-term infant in a primipara. They were single ovum twins that had died during the seventeenth week.

At a meeting of the Obstetrical Society of Hamburg, Rueder[15] showed a photograph of triplets, two of which were papyraceous fetuses and the third a premature child. The last was the second to be born, and lived only three hours.

After complete cervical dilatation in a para iv, Moss[16] found a hard mass with spicules on its surface presenting in front of the vertex. On bringing the head to the perineum with forceps, the mass was found to be a papyraceous fetus fitting over it like a bonnet. Following the normal male child there came its placenta and membranes, followed again by a second papyraceous fetus with an atrophied, bilobed placenta having two amniotic sacs and one chorion.

In a para v with mild pregnancy toxemia and hydramnios, Wallin[17] palpated a flattened mass to the right and in advance of the amniotic sac and fetal head. When the cervix had become 2½ inches dilated, this mass was recognized as the head of a papyraceous fetus. It was immediately extracted, and a living child weighing 6½ pounds was later delivered with forceps. Due to postpartum hemorrhage the placentas were removed manually, first that of the living child and then that of the mummified fetus. With the latter there was a second papyraceous fetus in an unruptured sac.

Before the Breslau Gynecological Society Lamy[18] reported finding two papyraceous fetuses in a membranous sac on the placenta which was expelled following the spontaneous delivery of a healthy child in a primipara. They were 8.5 and 7 cm. long, and were flattened to a thickness of 0.8 cm.

On the placenta which followed the spontaneous delivery of a full-term living female in a primipara, Wolff[19] found single ovum twin papyraceous fetuses of about four months' development.

Klimek's[20] patient was a primipara who had a normal labor at full term. Adjoining the normal placenta was a pale, degenerated one with single ovum twin papyraceous fetuses that had died at the fifth month.

In the literature there were found other cases which are so closely related to the subject under discussion that they may be mentioned for the sake of completeness. Both Bertog[21] and Maryanchik[22] describe triplet pregnancies with single papyraceous fetuses. Von Erlach[23] and Sänger[10] mention similar cases. Bretschneider[24] observed a papyraceous fetus accompanying a premature infant and an acardiacus. Two examples of the birth of triplets, one living and the other two macerated, have been recorded, one by Perdu,[25] the other by ten Doesschate.[26] Tartakoff[27] recently observed papyraceous twins in quadruple pregnancy.

REPORT OF AUTHOR'S CASE

H. H., forty-two years old, at full term of her eighth pregnancy, came to the hospital on Sept. 9, 1929 because of a slight discharge of blood from the vagina. Except for an attack of influenza in 1919, which resulted in a stillbirth at the eighth month, she had always been in good health. Her other pregnancies and labors had been uneventful. She had two sisters who were twins, probably double ovum.

Her last menstrual period had begun Dec. 3, 1928, and she had not had prenatal care. During the first two months of gestation she had experienced slight nausea, and in March had begun having bearing down pains in the lower abdomen. They had continued through the remainder of pregnancy, and occurred only when she was on her feet, interfering considerably with locomotion and making her fear that labor was imminent. There had been no bleeding previous to the day of admission, and the abdomen had enlarged steadily as in previous pregnancies.

The patient was of medium build and in apparently good health. General physical examination was essentially negative except for the findings of a full-term intrauterine pregnancy with the fetus in R.O.A. presentation and position, the presenting part at the pelvic inlet, and the cervix 3 cm. dilated. Pelvis was normal. Blood pressure 135/90. Blood Kahn reaction and urine were negative.

Labor pains began shortly after admission, and a living female child weighing 3600 gm. was born spontaneously four and one-half hours later. After ten minutes the placenta was easily expressed from the vagina, but seemed to be adherent to the uterine wall at one margin. Gentle, continued traction on the portion already delivered resulted in the removal of a mass of gray tissue which on careful examination proved to be a degenerated placenta with single ovum twin papyraceous

fetuses. Total blood loss during the third stage was estimated at 300 c.c. The puerperium was afebrile, and mother and child were discharged in good condition on the eleventh day.

The appreciation of the true condition presented by the secundines was clear only after their careful inspection. Together they weighed 820 gm. The placenta of the living child was entirely normal. It measured 24 × 15 × 2 cm., and showed a few white infarcts on its fetal surface. The rupture of the membranes was near the placental margin. Insertion of the umbilical cord was eccentric, and its length 40 cm.
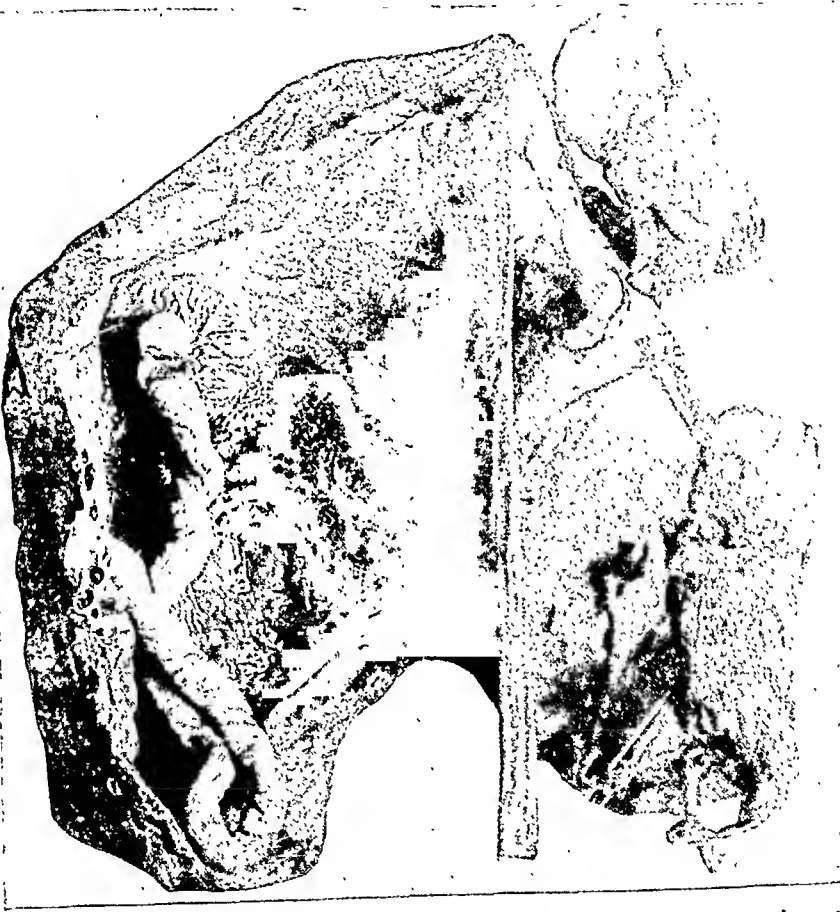
Fig. 1.—Normal and degenerated placentas with twin papyraceous fetuses in association with the latter.

Adjoining this placenta over a distance of 9 cm. and forming a continuation of its long diameter was a second one, pale, yellow, hard, and fibrotic, measuring 15 × 10 × 0.5 cm. The demarcation between the two was sharp and striking. The fetal membranes corresponding to the degenerated placenta were throughout almost their entire extent loosely adherent to those of the living child. On separating the two chorionic sacs it was found that pale, friable, but intact membranes were collapsed on the placental surface and that they contained within them two flat, ovoid bodies measuring about 4 × 10 cm. and only slightly elevated above the general level. The one lay near the center of the placenta, the other near the periphery. After opening the membranes containing them, these bodies were recognized as papyraceous fetuses. Each was enclosed by a definite amniotic sac from which the fluid had been absorbed, and the whole was enveloped by one chorion.

Although they had been firmly pressed against the placental surface, which showed no trace of blood vessels, they had made no depressions in it. The parts of each were so pressed together and the surface inequalities so filled in with a gray material resembling vernix caseosa that their first appearance was that of formless masses of dried, mummified tissue. Closer observation revealed the contour of the ribs through the closely applied skin, and, after extending the extremities, each mass took the form of a dried, flattened fetus of tanned appearance, with gray, wrinkled skin lying close to the bones and with the skull flattened from side to side. Their sex could not be recognized externally. The intestines of each were exposed and bile stained. The umbilical cords were delicate and fragile, measured 18 and 15 cm. in length, and, as nearly as could be determined, had direct placental insertions. Both fetuses had a crown-heel length of 13 cm. It is evident from the data given that they were single ovum twins that had reached about the fourteenth week of development. Roentgenograms of the fetuses showed a stage of ossification of their skeletons corresponding with the beginning of the fourth lunar month.

DISCUSSION

Of the nineteen cases of triplet pregnancy with twin papyraceous fetuses found described in the available literature, eleven occurred in primiparae and three in multiparae. In five cases the parity was not stated. The third triplet was premature in six instances, and one of these was dead. Seven of the pairs of papyraceous fetuses were single ovum twins. In the remaining cases their relationship was not definitely stated. Their period of development was not given in five cases, and in the remaining fourteen it had been arrested between the third and fifth months. As to the order of birth, one time both preceded, eight times both followed, and eight times one preceded and one followed the normally developed child. The order was not mentioned twice.

Concerning the cause of death of one or more fetuses early in the course of multiple pregnancy little is known. Lamy[18] regarded a fall at the third month as the probable etiologic factor, and Small[7] attributed it to the impoverished general condition of his patient. The woman observed by Müller[12] had bumped her abdomen against the corner of a stove between the third and fourth months. No one else even hazarded an opinion as to what may have been responsible in his case. From the information at hand about the one here reported no conclusion can be drawn. Among the causes that have been advanced there may be mentioned localized abnormalities of the decidua interfering with placentation, mechanical insults, lesions of the cord, and developmental anomalies incompatible with life. Inequality of circulation resulting from anastomosis of vessels in a common placenta or from the third circulation could not account for the death of both fetuses derived from one ovum.

In none of the cases reviewed were any symptoms mentioned which might have indicated with any great probability the early death and retention in the uterus of one or more fetuses. Toxemia of pregnancy

and hydramnios occurred a few times. In Small's[7] case the uterus was irritable for a month preceding delivery, and in that described by Pretty[3] there had been abdominal tenderness from the start. In the latter placenta previa was a complicating factor. Klimek's[20] patient suffered with severe backache for a few days during the fifth month of pregnancy. According to Strassmann[1] transitory bleeding may occur as the result of the death of one ovum. Wolff[19] observed this symptom in his case, but, as he states, it is too frequent from other causes to be of any diagnostic significance.

Halban[28] followed a case of twin pregnancy in which the death of one fetus in the fifth month was marked by the sudden diminution of acutely developed hydramnios, the onset of painful uterine contractions which persisted until the end of pregnancy, and the development of a furrow across the uterus which apparently indicated the boundary between the normal and dead ovum. He believed that such findings would be of definite value in diagnosis. It is interesting to note that in the case here reported intermittent pains appeared around the time of the death of the one ovum, and that the uterus was unusually irritable throughout the remainder of gestation. The foreign body action of the dead ovum was in all probability responsible for this. The patient was questioned regarding a sudden diminution in size of her abdomen or a temporary cessation of its enlargement, but had noticed neither. No furrow of the kind described by Halban was present. It is apparent that a diagnosis depending upon such criteria can rarely be made, and that the condition will have to be recognized by close observation at the time of delivery. It seems doubtful that the osseous system of a small papyraceous fetus would be dense enough to make possible its visualization with the x-rays.

The clinical importance of single or twin papyraceous fetuses is not great. When presenting first they may give rise to obstruction of labor or, more frequently, to diagnostic errors. Their retention may result in postpartum or puerperal hemorrhage or puerperal infection. Small papyaceous fetuses are recognized only by careful examination of the after-birth. They are probably often overlooked, and their occurrence is doubtless more frequent than the small number recorded in the literature indicates. Bazzanella[9] discovered a papyraceous fetus among the blood clots that came with a normal placenta. He concluded logically that at least a degenerated placenta must have been left behind, but did not interfere because there was no abnormal bleeding. After forty-eight hours the second placenta with a second mummified fetus was expelled.

SUMMARY

1. The occurrence of twin papyraceous fetuses in triplet pregnancy is rare. A case is here reported, and data are brought together on nineteen out of twenty others found in the available literature.

2. A papyraceous fetus is found almost exclusively in multiple pregnancy which advances to or near term. Mummification is most frequent in fetuses dying between the third and sixth months of development.

3. Regarding the cause of early death of one or more fetuses and continued development of one or more others there is no information that is convincing.

4. There are rarely any symptoms or signs that suggest such an occurrence, and the diagnosis can be made definitely only at the time of delivery. Even then it may be missed by careless examination of the secundines.

5. A papyraceous fetus is of some clinical significance since it may cause diagnostic errors, exceptionally obstruct labor, or, through its retention, result in postpartum or puerperal hemorrhage or puerperal infection.

REFERENCES

(1) *Strassmann, P.:* Die mehrfache Schwangerschaft, in von Winckel's Handbuch der Geburtshülfe, Wiesbaden, J. F. Bergmann 1: 781, 1904. (2) *Weber, F.:* Die mehrfache Schwangerschaft, in Döderlein's Handbuch der Geburtshilfe, München und Wiesbaden, J. F. Bergmann 3: 221, 1920. *Pretty, W.:* London M. Gaz. 36: 1392, 1845; 38: 572, 1846. (4) *Van Oteghem:* Bull. Soc. de Med. de Gand. 28: 100, 1861. (5) *Lyle, W. V.:* Brit. M. J. 2: 440, 1868. (6) *Reuss, P.:* Arch. f. Gynäk. 4: 123, 1872. (7) *Small, B.:* Canada M. & S. J. 12: 483, 1883-84. (8) *Gutman, C.:* Ein Fall von Drillingsgeburt mit einem lebenden Kinde und zwei Fötus papyracei, Inaug. Dissert. Karlsruhe, 1885. (9) *Bazzanella, V.:* Zentralbl. f. Gynäk. 15: 625, 1891. (10) *Sänger:* Zentralbl. f. Gynäk. 17: 150, 1893. (11) *Lambinon, H.:* N. Arch. d'obst. et de Gynéc. 9: 566, 1894. (12) *Müller, A.:* Monatschr. f. Geburtsh. u. Gynäk. 5 (Ergänzungsheft): 207, 1897. (13) *Aldridge, G.:* Brit. M. J. 2: 140, 1910; Lancet 1: 1619, 1910. (14) *Nolte, R.:* Über Foetus compressus sive papyraceus, Inaug. Dissert. Kiel, 1913. (15) *Rueder:* Zentralbl. f. Gynäk. 39: 615, 1915. (16) *Moss, E. L.:* Brit. M. J. 2: 41, 1915. (17) *Wallin, C. C.:* Northwest Med. 22: 140, 1923. (18) *Lamy:* Zentralbl. f. Gynäk. 49: 1505, 1925. (19) *Wolff, P.:* Zentralbl. f. Gynäk. 50: 1313, 1926. (20) *Klimek, J.:* Foetus Papyraceus, Thesis. Breslau, 1926. (21) *Bertog, E. J.:* Über einen Fall von Drillingsschwangerschaft mit einem Foetus papyraceus, Inaug. Dissert. Halle, 1911. (22) *Maryanchik, N. P.:* Vrach. Gaz. 9: 317, 1902. (23) *von Erlach:* Zentralbl. f. Gynäk. 18: 439, 1894. (24) *Bretschneider:* Zentralbl. f. Gynäk. 27: 668, 1903. (25) *Perdu:* Loire. Med. 30: 139, 1911. (26) *ten Doesschate, A.:* Nederl. Tijdschr. v. Geneesk. 63: 1357, 1919. (27) *Tartakoff, J.:* New England J. Med. 202: 78, 1930. (28) *Halban, J.:* Zentralbl. f. Gynäk. 38: 332, 1914.

216 SOUTH STATE STREET.

ANILINE POISONING IN THE NEWBORN, WITH A REPORT OF THIRTEEN CASES*

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THIS paper will describe thirteen cases of an unusual type of poisoning that occurred at the Kings County Hospital on October 28, 1929, in the service of Dr. H. M. Mills.

Hospitalization *en masse* is a necessary means of handling the sick of a community. It has numerous factors in its favor, but also has many factors that we accept only because we must, and not because we so desire. It is only necessary to cite one or two to impress upon our minds how undesirable hospitalization can be at times; such as the rapid spread of impetigo on a children's ward, or any form of contagious disease, as measles, diphtheria, etc. The above are what one would call the usual dangers of hospitalization. This paper will deal with an uncommon and really unsuspected source of danger, one that could excusably be overlooked.

The obstetric ward of the Kings County Hospital generally has a census of 30 to 50 newborn infants. These patients are handled in a routine manner, each baby receiving every care that all the others receive and also at the same times of the day. Similarly, all of their clothes come from a common laundry, and the babies receive complete changes of attire at the same times. Therefore, if the clothes were to act as a common carrier for a danger to the welfare of these patients, they would all be exposed to it in essentially the same manner and to the same degree.

On Saturday, October 26, 1929 (two days before the onset of the present trouble), Ward 18—the obstetric service—received a new supply of babies' apparel and blankets. These were all freshly stamped in large type with the identifying lettering WARD 18, K.C.H. This is the laundry mark so that in the future when returning from the laundry, the articles will reach their proper destination. These articles of clothing were put in use about 7 o'clock Monday morning, so that by noon practically every child had some fresh articles of clothing in contact with its body.

At 4 p.m. of that day, the nurse in charge of the babies called the intern's attention to baby K, who apparently had taken a sudden bad turn. On examination, the baby was observed to have a marked cyanosis of its skin, particularly of its lips, mucous membranes, eyelids, forehead, ears, and extremities. Respirations and pulse were rapid, but the temperature was normal. The child had refused its

3 P.M. feeding, and at that time appeared drowsy, weak, and apathetic; and was entirely unresponsive to handling. Its general appearance was that of a bluish colored wax doll. Complete physical examination revealed nothing wrong except the marked cyanosis, cold extremities, and rapid respirations and heart action. Expectant treatment was instituted.

It was further noticed that the babies as a group were reluctant about taking their 3 P.M. feeding. At about 5 P.M. baby K had a particularly bad spell, during which he seemed to be gasping for air. This lasted a few minutes and the baby then returned to its previously cyanosed and lethargic condition. Between 4 and 5 P.M. three other babies were observed to be cyanosed; namely, babies Kl, B, and C.

At about 5 P.M. baby B was observed to be quite stiff in addition to his marked degree of cyanosis. This stiffness lasted for a few minutes and then subsided, and the baby was then in quite a similar condition to baby K. At the 6 P.M. feeding the babies as a group were more reluctant about nursing than previously, and some refused to nurse at all, acting as though they were asleep at the breast. When the infants were being returned to their cribs, the nurses observed that many more babies were cyanosed and drowsy. This of course excited some alarm. Due to the general involvement, it was assumed that there must be a common agent to explain the sudden illness of thirteen babies out of a total of thirty-two. The first thing considered was possible carbon monoxide poisoning. However, the only source for this poisonous gas could be the illuminating gas supply, and no leakage was discovered. For that matter, the atmosphere of the room appeared to be quite normal, as the nurses had been in the room as long as the babies without the slightest maleffects. Despite our self-assurance that the atmosphere was not unduly contaminated with unhealthy amounts of carbon monoxide gas, the room was thoroughly ventilated. No definite improvement in the condition of the cyanosed infants was observed. Finally it was found that the linen had been put into use without first being boiled and washed. The new linens were investigated and found to have fresh print on them, as has been previously described. In practically all the cases, the printing was found to be in contact with some part of the babies' bodies; in fact, definite staining was found on the skin of eight of the thirteen babies. We now felt certain that the etiology of this unusual poisoning was discovered.

The immediate measures that were undertaken to eradicate the danger were as follows:

1. All new linens were removed from contact with the infants.

2. The babies were thoroughly washed with alcohol or ether to remove all of the print stains, and were then clothed in linen that had already been boiled and washed.

3. Administration of a mixture of oxygen and 5 per cent carbonic acid to babies as needed.

4. Careful observation of all babies every few minutes, so that immediate measures could be undertaken if a patient suddenly became worse.

In order not to overburden the nursing staff and the laboratory technician, three cases were chosen at random for a complete work-up. We felt that the findings in the three cases would be typical of the group. Therefore, in these cases a study was made of the temperature, pulse, and respiration, and blood specimens were examined by means of a spectroscope to discover whether or not methemoglobin was present. In two of the three cases blood counts and uranalysis were done. However, in all cases a detailed study was made of the symptomatology and clinical findings that were presented; and we therefore studied the cases as to the degree of cyanosis; where the cyanosis was most evident; how the babies nursed; the degree of apathy; the type of response to stimuli, such as handling the baby; whether convulsions were observed; as to the definite finding of dye stains on the babies' bodies; the type of cry, whether strong or weak; the condition of the extremities; and lastly the subsequent course of the cases.

The spectroscopic examination of the blood in all three cases showed the definite presence of methemoglobin.

The urine examinations revealed only slight changes from the normal; that of baby K had a light amber color, cloudy appearance, a very faint trace of albumin, no sugar, gave an acid reaction, and contained a few leucocytes, many uric acid crystals, a few epithelial cells, an occasional red blood cell, and amorphous urate sediment. That of baby B had a light amber color, appeared cloudy, gave an acid reaction, contained no sugar or albumin, and had a few epithelial cells and a few leucocytes.

The blood counts showed no unusual findings but that of suppression of the total leucocyte count in both cases, and a definitely low red blood cell count in one case. However, the baby with the low red blood cell count normally was quite pale and sallow complexioned. The blood pictures were as follows:

	Baby K		Baby B	
W.B.C.,	10,600	W.B.C.,	7,200	
Polymorphonuclears,	47 per cent	Polymorphonuclears,	53 per cent	
Lymphocytes,	37 per cent	Lymphocytes,	34 per cent	
Large monocytes,	13 per cent	Large monocytes,	12 per cent	
Eosinophiles	3 per cent	Eosinophiles,	1 per cent	
R.B.C.,	3,500,000	R.B.C.,	5,590,000	

In summation of our detailed study of the clinical findings, we observe:

1. The pulse in every case became very rapid but maintained its regularity and rhythm.

2. There was no variation of the temperature from normal.

3. Respirations were greatly accelerated but continued regular.

4. Cyanosis was marked in practically all cases.

5. Cyanosis was most evident on the lips and eyelids.

6. All suffered from anorexia.

7. The degree of apathy was pronounced in practically all cases.

8. The response to stimuli was decreased in every instance.

9. Only one case showed what we could consider a convulsive seizure.

10. Dye stains were found on the skin of eight of the thirteen babies.

11. The cry was decreased in strength in every case.

12. The extremities tended to be cold and cyanosed in all cases.

13. The subsequent course showed complete recovery in every case within a period of from twenty-four to seventy-two hours, without any observable harmful effects.

The dye was analyzed by Dr. G., pathologic chemist of the City of New York, who stated that the dye mixture contained phenol (carbolic acid), levulinic acid, aniline, and induline dye (spirit soluble). He added that the cyanosis could result if either the phenol or aniline was absorbed. However, Dr. G. did not believe the dye itself could have caused this condition, as "it would not be absorbed; first, because the molecule is very large, and second, because the dye is extremely insoluble in water."

In refutation, we may mention the work of Rayner[1] who, as far back as 1886, exposed the skin of a normal healthy child to aniline and observed that the infant developed symptoms exactly similar to those of the cases of suspected aniline poisoning that he had under his observation. Unquestionably many similar cases have occurred in the past, and we will be forced to accept the fact that one of the above substances, probably aniline, was the cause of our cases of poisoning.

A review of the literature covering this unusual type of poisoning reveals the fact that aniline poisoning is closely allied to nitrobenzene poisoning as to mode of susceptibility, symptomatology, and the effects manifested. For this reason writers have tended to report the cases as "dye poisoning"; and whether or not the specific poisoning substance was aniline or nitrobenzene was of little moment, as they produced similar types of reactions in the living organism. Conflicting statements are found in the literature as to the toxicity of aniline and nitrobenzene. Miner[7] believes that the true toxic agent must be a by-product associated with the chemical substance, as otherwise he presupposes the occurrence of many more cases than have been reported. In refutation to the above statement, we may quote Muehlberger[10] who states that probably many times more cases of dye poisoning actually occur than are reported. He also adds that, "It is now

definitely known that nitrobenzene and aniline, when pure, are toxic and absorbed through the skin."

All of the accepted authorities are not entirely in accord as to the way in which aniline causes its poisoning phenomena. Young believes aniline poisoning causes a cardiac type of death. In his studies he at no time found evidence of methemoglobin in the blood of his subjects, but by means of electrocardiographic studies he observed that the specialized conducting tissues of the heart were affected and produced heart-block. This worker further observed that the heart stopped beating before the cessation of respiration. The blood in these cases was observed to be of a brownish color and just before death showed an increase in the red blood cells, hemoglobin, and oxygen capacity of the blood. On the other hand Zeligs[9] and Neuhoff,[3] in independent articles, state that the symptomatology is the result of the formation of methemoglobin in the blood. By this means the oxygen content is reduced from a normal of 17 per cent to as low as 1 per cent. The tissues are therefore poorly supplied with oxygen and symptoms of asphyxia supervene. In view of our observation of three blood specimens containing methemoglobin by spectroscopic test, we are inclined to concur with Neuhoff and Zeligs, as to methemoglobin being the chief factor in causing the poisoning symptoms. In further support of this opinion we may cite Cushing[2] who states that the poisoning action of aniline results from the formation of methemoglobin in the blood. Young in his studies showed that when 0.1 of a gram of aniline per kilogram of body weight was injected into the vein of a dog, death resulted in a few minutes, death being cardiac in type.

Treatment of aniline poisoning is a relatively simple procedure. It consists of removal of the dye-containing clothing from the patient. The skin should then be thoroughly cleansed with alcohol or ether in order to remove the dye that may be adherent. Where dyspnea and cyanosis are most marked, the inhalation of a mixture of oxygen and 5 per cent carbon dioxide is of value. Stimulants, such as camphor and oil, caffeine, sodium caffeine benzoate, and adrenaline are used as indicated. Fluids should be pushed continuously. However, the most important consideration is prophylaxis; all danger from this source of poisoning can be eliminated by simply boiling all freshly stamped linens, as in this way the dye is inactivated.

REFERENCES

(1) *Rayner, W.:* Brit. M. J. 1: 294, Feb. 13, 1886. (2) *Cushing, A. R.:* A Textbook of Pharmacology and Therapeutics, ed. 8, Lea and Febiger, 1924, pp. 38, 478, 479. (3) *Neuhoff, F.:* J. Missouri M. A. 18: 53, 1921. (4) *Stone, Willard J.:* J. A. M. A. 43: 977, 1904. (5) *Stiffel, R. E.:* J. A. M. A. 72: 395, 1919. (6) *Stiffel, R. E.:* J. A. M. A. 72: 592, Feb. 22, 1919. (7) *Miner, C. S.:* J. A. M. A. 72: 593, Feb. 22, 1919. (8) *Patek, A. J.:* J. A. M. A. 86: 944, March 27, 1926. (9) *Zeligs, M.:* Arch. Pediat. 46: 502, August, 1929. (10) *Muehlberger, C. W.:* J. A. M. A. 84: 26, June 27, 1925.

1650 FORTY-NINTH STREET.

A CASE OF NOSENCEPHALUS WITH EVENTRATION OF THE ABDOMINAL AND CHEST ORGANS, POLYHYDRAMNIOS, AND OTHER ANOMALIES

By Silik H. Polayes, M.D., and Jacques D. Soifer, M.D.,
Brooklyn, N. Y.

(From the Department of Pathology of the Jewish Hospital)

MRS. L. K., a gravida i, aged twenty-seven, was admitted to the private obstetric service of Dr. H. B. Bolcy on June 6, 1929. The family history was irrelevant. Appendectomy six years ago. Patient was married three years and has had several "stretchings" for sterility. The menstrual history was normal. The last regular period occurred November 2, 1928, but the patient could not recall whether a dilatation had been done after the last menses. Upon examination she was found to be pregnant and measurement of the pelvis showed a deep symphysis, slight narrowing of the pubic arch and a prominent left ischial spine.

The pregnancy progressed normally for the first thirty weeks, then the abdomen began to enlarge very rapidly—and toward the end of the thirty-first week, the size of the uterus was larger than that of a full-term gravidity. A monstrosity was suspected at this time. A week later, on June 6, 1929, about 4 P.M., while the patient was at home, the membranes ruptured spontaneously and large quantities of amniotic fluid escaped. The exact amount could not be estimated. One hour later, the patient was admitted to the hospital, although she was not in labor.

Abdominal examination showed the height of the fundus to be that of a thirty-two weeks' gravidity. The breech was in the fundus, the small parts were to the right, the back was toward the left, and the fetal heart sounds were best heard in the left lower quadrant. Per rectum, the cervical canal was found effaced, the cervix thinned out, and the external os showed one finger dilatation. The presenting part was approximately at the level of the ischial spines. Fluid was escaping from the vagina. Temperature and pulse rate normal. Blood pressure was 120/78.

At eight o'clock the next morning (labor began at 3 P.M.), the external os was fully dilated. Vaginal examination revealed a compound presentation, consisting of the left shoulder (Sc.L.A.) and the right hand. A version and breech extraction were done with the delivery of a stillborn monster. The placenta, normally situated, was expressed ten minutes later. It showed no gross pathology. There was no undue postpartum bleeding. The puerperium was uneventful except for a rise in temperature to 100.8° F. on the second day. The patient was discharged on the twelfth day.

The Wassermann and Kahn tests of the patient and her husband were negative. The microscopic examination of the placenta showed no evidence of syphilis. There were no abnormalities in the patient's genital tract; but an hydramnios was present, a frequent association with monstrosities.

Description of Monster.—The fetus, a male, 32 cm. in length, presents three different major anomalies; cranioschisis, thoraco- and hypogastroschisis, and eventration of all the viscera. There are many lesser abnormalities.

The cranioschisis is of the anteromedian type (mero-acrania); both the parietal and frontal bones are almost entirely lacking. The brain is represented by a small

portion of cerebrum which is scarcely recognizable as such, being a conglomeration of brain tissue and blood. The cerebellar tissue is more easily distinguished, but is vestigial and cystic in character. The whole mass, covered by a thin membrane, apparently meninges, is exposed, due to the lack of cranial bones and integument (nosencephalus).

The cranial bone deformity and a marked exophthalmus give the face a frog-like expression. The forehead is markedly narrowed, due to the frontal bone defect. There is almost a complete absence of nasal bones, producing a flattening of the bridge of the nose and an undue prominence of the alae nasi. A cyst about 1 cm. in diameter, is attached to the right ala. There is a marked harelip and cleft-

Fig. 1.—Anteroposterior view.

palate. The undeveloped inferior maxilla produces a receding chin. The aural appendages are rudimentary and the neck is reduced to a mere fold of skin, due to the defective cervical vertebrae.

The sternum is absent, which causes a defect in the anterior chest wall. The entire thoracic cavity is exposed and its contents are almost completely eventrated. The anterior abdominal wall is wholly lacking and the celomic organs are likewise eviscerated. The chest and abdominal cavities are greatly distorted by the extreme lordosis and scoliosis of the spinal column. The photograph (Fig. 1) depicts rather vividly, the anomalous relations of the thoracic and abdominal viscera. The liver is very large and conceals the chest organs. The lungs are compressed by the dome of the liver and the curvature of the thoracic vertebrae. The heart and pericardium are displaced to the left, and its apex can be seen exposed between the liver and the ribs that form the margin of the open chest cavity.

The loops of intestine which protrude in a chaotic mass, are entirely outside of the body. The kidneys and related internal genitourinary organs, although hidden by intestines, are also eviscerated. The pubic bones have failed to unite producing an extrophy of the bladder. The external genitalia are markedly enlarged. Both testes have descended into the scrotum which is thick-walled. The corpora spongiosa and the glans penis are considerably hypertrophied.

The left upper extremity is represented by a small prominence of skin and sub-cutaneous structures adjoining the acromial end of the clavicle. To a point just below this projection is attached a cord-like mass consisting of skin and sub-cutaneous tissue, which is attached at its distal end to the back of the trunk.
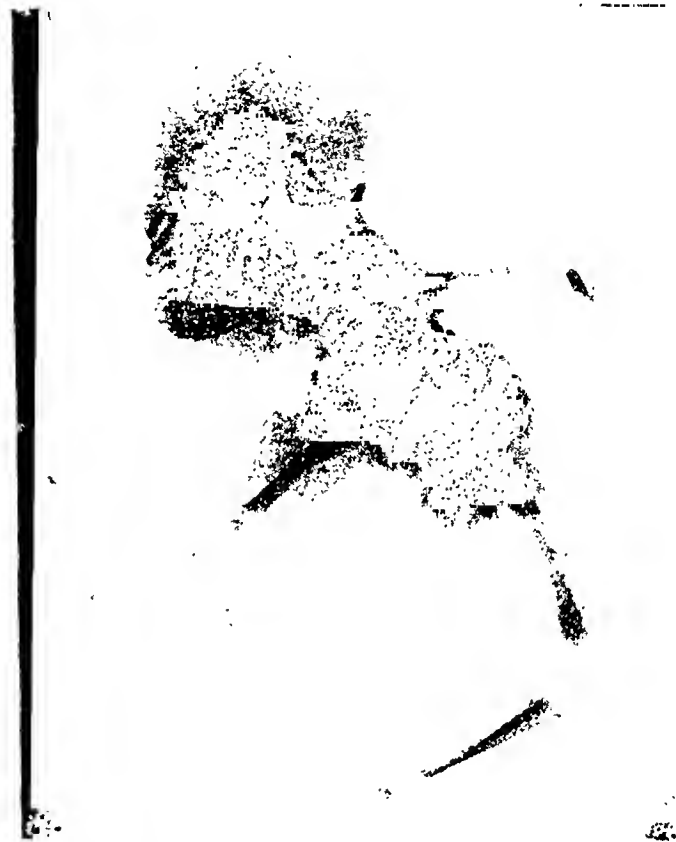
Fig. 2.—X-ray picture of fetus in position shown in Fig. 1.

The right upper extremity shows a compensatory hypertrophy. It is rigidly twisted around the back of the fetus so that the thumb points to the left buttock. The fingers are tightly flexed and webbed. The joints of the lower extremities are all acutely flexed. The right foot is hooked around the left leg. The toes are webbed. There are no supernumerary digits. The soft tissues of the buttocks and thighs are unduly thickened due to the overdevelopment of the musculature in this region.

COMMENT

This case is reported because it is an extremely unusual type of monster. Greenhill, Pribram and Brochocki have pointed out somewhat similar cases. Ballantyne, describing this anomaly, cites a few cases, and emphasizes its infrequency. A thorough search of the literature for other monstrosities of this character

is difficult. In the first place, there is no standard classification of monsters, but a host of classifications, many of which are quite complicated and inapplicable. Second, monstrosities are frequently incorrectly classified by authors who report these cases. For example, aerania is often confused with acephaly, exencephaly with anencephaly, anencephaly with aerania, et cetera. Third, cases may be hidden in articles, the titles of which give no clue to the subject that is being investigated. Fourthly, the titles of papers are often ambiguous, as, for example, ''An Unusual Monstrosity'' or ''A Rare Fetal Anomaly.''

A plea is therefore made for a standard nomenclature which will make possible a satisfactory classification of fetal monstrosities. It is also urged that case reports should be accurately and clearly titled.

REPORT OF TWO CASES OF TWIN PREGNANCY WITH EARLY DEATH OF ONE FETUS*

By T. J. Parks, M.D., Fairfield, Ala.

AT THE Employees' Hospital of the Tennessee Coal, Iron, and Railroad Company approximately 400 patients are delivered a year, almost half of whom make visits to the prenatal clinic. Some of the remainder are sent in by district physicians because of obstetric difficulties; others for various personal reasons.

Out of all the cases that have been delivered at this hospital since it opened its doors in November, 1919, the two cases about to be detailed are the only ones on record here; and, unusual as it is, they came within one week of each other. Such cases are only mentioned as possibilities in textbooks on obstetrics. A survey of the recent American literature does not reveal any similar cases, and the Package Library of the American Medical Association could not furnish me with any literature on the subject.

Neither of the patients was cared for in our prenatal clinic. The first and more striking case came to the hospital because of the spontaneous rupture of the membranes and escape of clear fluid before the onset of labor; the second case was sent in, after being seen but not examined by a district physician, with the diagnosis of placenta previa, because of the bloody fluid that she passed vaginally, without having any labor pains.

CASE 1.—Mrs. G. M., white, American, multipara, aged thirty-three, was admitted to the hospital in the last trimester of pregnancy, in early labor. She was in good physical condition. Blood pressure was 100/60, urine negative, no signs of toxemia, Wassermann negative, membranes ruptured, fetal heart sounds normal.

She had always enjoyed good health, except for bronchial asthma the past four years.

Her maternal grandmother was one of twin sisters, who were said to resemble each other closely. Her great aunt on her mother's side was one of twins, and they looked alike. There were no twins on her paternal side. The patient's husband's maternal grandmother was one of twins, and he had an aunt who bore twins. He himself was one of twins, both of whom were boys; but his twin, who was as large as he, was born dead.

The last menstrual period ended thirty-two weeks before admission, but it was abnormal on account of its brevity.

The patient had had four normal full-term babies and no miscarriages.

During the present pregnancy she had not felt as well as in former pregnancies. Nausea began about the tenth week, which persisted until after delivery. The week previous to the rupture of the secundines, she was troubled by a profuse, irritating leucorrhea with a foul odor.

Labor proceeded normally, and a well-formed male infant, weighing 1350 gm. and measuring 39 cm. from vertex to external malleolus, was born. The after-birth came ten minutes later.

Upon inspection, the after-birth (Fig. 1) was found to be composed of one piece, half of which appeared normal on its maternal and fetal surfaces; the other half was flattened and grayish on its maternal surface. The membranes of the latter
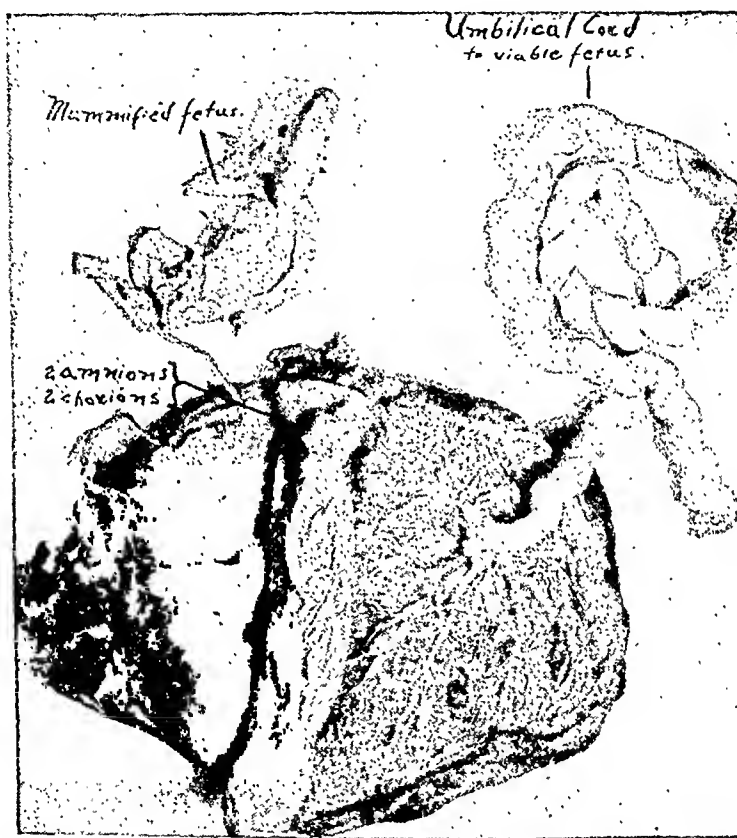
Fig. 1.—Fetal surface of placentas of Case 1 with two amnions and two chorions rolled to center.

half were loose, but intact. Upon opening the sac, a dead fetus 14 cm. long was found in a state of perfect preservation. It was attached to the placenta by an umbilical cord corresponding in size to that of the fetus. The fetus was only slightly compressed, although surrounded by only approximately two or three ounces of clear almost odorless fluid, which was slightly darker than normal amniotic fluid. There were two amnions and two chorions. The placentas were approximated to each other. One appeared normal, microscopically; it measured 16.0 by 11.5 by 2.7 cm. The flattened, hard placenta appeared markedly fibrotic and the villi were decreased in number. It measured 14.0 by 8.0 by 0.8 cm.

CASE 2.—Mrs. R. T., white, American, multipara, aged twenty-seven, was admitted to the hospital with diagnosis of placenta previa. She was in good condition. No

pains, no bleeding, blood pressure was 120/68, fetal heart normal. No evidence of placental tissue was found on vaginal examination.

Family history irrelevant, no twins on either side.

Last menses ceased thirty-six weeks before admission.

She had had two normal full-term babies, and one miscarriage at five months, cause unknown.

During the present pregnancy she had not had any discomfort. Upon careful questioning, it was found that there was a profuse flow of fluid and that it was only blood tinged. She went into labor spontaneously the same afternoon as admitted, and was delivered a few hours afterward of an apparently normal female
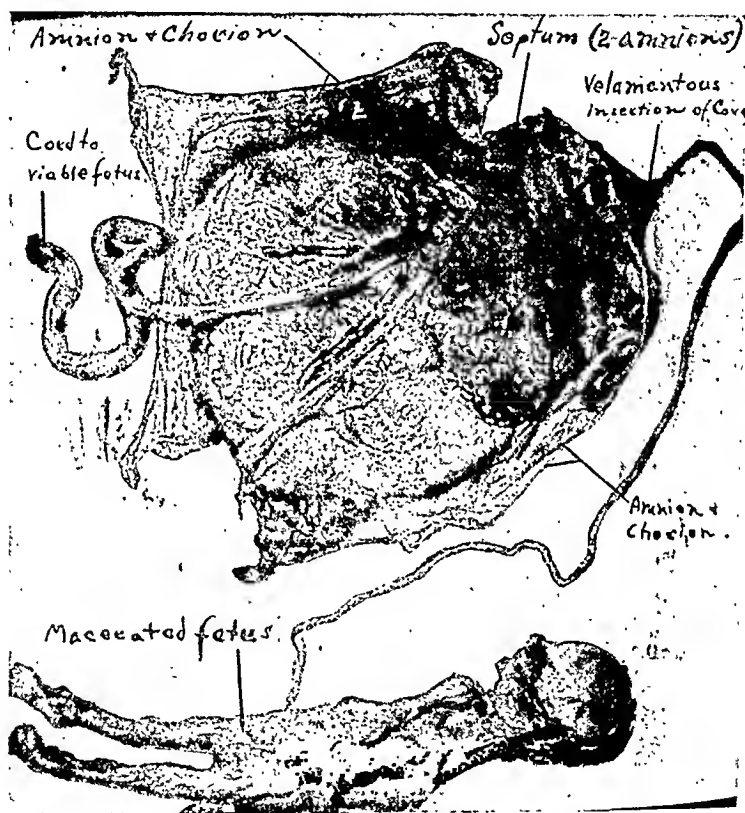
Fig. 2.—Fetal surface of placenta of Case 2 showing septum of two amnions and velamentous insertion of umbilical cord.

infant, weighing 1772 gm. and measuring 43 cm. from vertex to external malleolus. The placenta (Fig. 2) protruded from the vagina immediately following the child. The maternal surface was found to appear normal, except for a small area on one edge that was firmer and had a larger number of grayish streaks than the remainder of the organ. The fetal surface was found to be divided into two unequal portions by two thin membranes. The larger portion was normal in appearance. The smaller division contained a macerated fetus 23.5 cm. long. The umbilical cord was attached to the secundines. There were two amnions and one chorion in this case. Both amniotic sacs had ruptured before birth.

The entire placenta measured 15.5 by 15.5 by 2.3 cm. The microscopic appearance of the placenta was normal, except for the firm area which showed a moderate amount of fibrous tissue.

COMMENT

Both of these cases are probably uniovular in origin; Case 1 because the placentas are approximated, and Case 2 is definitely so, as there is but one chorion.

The cause of the early death in Case 1 is not clear. Some of the causes of early intrauterine death in general are: embolus of a large vessel, torsion of the umbilical cord, developmental anomaly or relative weakness, and the occurrence of a retroplacental hematoma. As the placental area supplying the fetuses in Case 2 was so unequally divided, it must be concluded that asphyxia from developmental anomaly was the cause of the intrauterine death in this case.

Mrs. G. M. probably went into premature labor because of a diseased cervix and the inevitable local infection of the membranes and the resultant weakening which predisposed to their rupture. The same thing could have been true in Case 2. However, it seems more likely that it was nature's method of ridding the uterus of a macerated fetus.

Watson has shown, experimentally, in rabbits[1] that amniotic fluid is not secreted after fetal death, which fact is borne out in Case 1.

The placenta and dead fetus in Case 1 were held in place by the pressure exerted by the intact membranes and adherent placenta of the living twin. It has been shown that a uterus does not attempt to cast off its contents until a zone of separation has been formed.[1]

The placenta of the fetuses in Case 2 has anastomosing blood vessels just as any single placenta. Also, in this case the fetus evidently died first, and, as is the rule in such cases, the placenta kept developing for a considerable length of time afterward.[2]

I am indebted to Dr. Walter C. Jones, Pathologist, Employees' Hospital, Fairfield, Alabama, for the microscopic examination of the placental tissue and for his very helpful advice.

REFERENCES

(1) *Watson, B. P.:* Scottish Med. & Surg. J., January, 1906.   (2) *Ballantyne:* Antenatal Pathology and Hygiene: The Foetus, Edinburgh, 1902.   Antenatal Pathology and Hygiene: The Embryo, Edinburgh, 1904.

Dalrymple, S. C.: Thrombosis of the Interlobular Arteries of the Kidneys in Pregnancy. New England J. Med. 203: 160, 1930.

Bilateral cortical necrosis, resulting from infarction of the cortical or interlobular arteries and occurring postpartum in cases of toxemia of pregnancy, is rare. A typical instance of this condition together with autopsy findings is reported in this paper.

EHRENFEST.

PREGNANCY AS A COMPLICATION OF NEUROFIBROMATOSIS

(VON RECKLINGHAUSEN'S DISEASE)*†

BY J. IRVING KUSHNER, M.D., NEW YORK, N. Y.

ALTHOUGH reports on the association of neurofibromatosis and pregnancy have so far been very few, it has been the surmise of all those who have studied the subject that the incidence of this condition is probably much greater than the few reported cases would indicate. The impression exists that the condition is frequently unrecognized. Especially has this idea been impressed upon us, when during the past year we have seen four cases, in an obstetric service of only moderate extent.

Tumors of the peripheral nervous system form a very important and complex group of neoplasms of frequent occurrence and varied clinical course. In one general group the growth affects the connective tissue structures of the nerve, the tumors are fibrous in character and are commonly classed as fibromas. When they are multiple we have the condition known as "von Recklinghausen's disease" or neurofibromatosis. The cause is unknown. It is assumed to be a congenital disease, sometimes familial and rarely hereditary. Generally the disease is benign and frequently characterized by no symptoms. If the tumor compresses a nerve severely, objective sensory disturbances may occur.

Cases seen in the Bronx Hospital are here given:

R. M. No. 25503. Age 20, Irish, para i. She was first seen in prenatal clinic on October 8, 1929, being then seven months pregnant (last period April 6, 1929). Her measurements were normal. The fetal heart was heard in the right lower quadrant. The fundus was one finger above the umbilicus. Blood pressure 110/60. Urine negative.

It was noticed that she had multiple pea-sized nodules developing in the subcutaneous tissue, over the entire body and extremities. These tumors were freely movable, hard, and tender; with pigmentation of the overlying skin. A diagnosis of neurofibromatosis was made which was confirmed by the consulting dermatologist, Dr. A. Rostenberg.

The patient stated that she first began to notice the nodules eleven years previously—and that there had been no increase in these lesions for seven years. In February, 1929, she was a patient at the General Memorial Hospital where a diagnosis of neurofibromatosis was made. At that time she received three x-ray treatments.

On January 14, 1930, she was delivered spontaneously of a male child weighing eight pounds and normal in every respect. She made an uneventful convalescence.

F. H. No. 23113. Age 34, Jewish, para iii. She was seen first in the prenatal clinic on November 15, 1929, with small nodules over costochondral junctions and entire back; also numerous brownish, circular pigmented nodules from 1 mm. to

3 cm. all over skin of the body. A diagnosis of neurofibromatosis was made and confirmed by Dr. A. Rostenberg, the consulting dermatologist.

She was delivered spontaneously of a normal child and was discharged after an uneventful convalescence.

S. S. No. 23624. Age 29, Jewish, para ii. She was seen on January 3, 1929, in the prenatal clinic. She showed irregular areas of brownish pigmentation generally distributed over the trunk of her body, along with some superficial fibromatous nodules about the size of a pea. In addition there were numerous soft, slightly protruding areas of a brownish-red color easily invaginated. A diagnosis of von Recklinghausen's disease was made.

She was admitted to the hospital in active labor on April 10, 1929, and delivered spontaneously of a normal child.

In a dermatologic consultation with Dr. S. Feldman on the third day postpartum the diagnosis was confirmed.

B. F. No. 24076. Age 39, Jewish, para iv. Seen in the prenatal clinic three months before delivery with multiple papillomata and small raised pigmented areas over the chest and back. The diagnosis of neurofibromatosis was made and confirmed by Dr. A. Rostenberg.

The most frequent fibroma of the skin occurring in multiple form is the so-called fibroma molluscum. von Recklinghausen,[1] in 1882, showed that this tumor arises from the cutaneous nerve filaments, a conclusion which had been suggested by some previous writers and verified by many later studies. He traced degenerating nerve fibers in several characteristic cases and stated that all these tumors arise from nerve-trunks or filaments.

Hirsch[2] reported a case of neurofibromatosis in a female, age 37, becoming worse during the seventh month of her first pregnancy, which soon after the termination of that pregnancy underwent a process of remission.

Nishizaki[3] cites a case of von Recklinghausen's disease occurring in a married woman 22 years old, with a history of pigmented spots present since the age of six. In the third month of her pregnancy these were noticed to increase in size and number. In the fifth month after labor the tumors faded and decreased. But when she was pregnant for the second time the process repeated itself.

Wise and Eller[4], in reviewing the literature on von Recklinghausen's disease, cite Feindl, who reports a case of neurofibromatosis first appearing at time of childbirth.

Rosensohn[5] reported a case of von Recklinghausen's disease in the Bulletin of the Lying-In Hospital. He pointed out that any procedure which becomes a routine may ignore features which make every case interesting.

In presenting these cases, the desire has been to stimulate the thorough examination of every patient—even those seen on a maternity service. The obstetrician must not be satisfied with the idea that a mother can have no other abnormality than one connected with her pregnancy. The histories noted in this article are given in detail because of the dearth of reports showing the association of the two conditions.

I wish to express my thanks to Dr. Meyer Rosensohn for permission to publish these cases; and also to Miss Dora Laks, historian of The Bronx Hospital, for her aid in obtaining these records.

REFERENCES

(1) *Ewing, J.:* Neoplastic Diseases, p. 165, 1928, Philadelphia, W. B. Saunders Company. (2) *Hirsch, E.:* Med. Klin. 23: 983, 1927. (3) *Nishizaki, Sh.:* Jap. J. Obst. Gynec. 28: 241, 1928. (4) *Wise, F., and Eller, J. J.:* J. A. M. A. 86: 87, 1926. (5) *Rosensohn, M.:* Bull. Lying-in Hosp., N. Y., 11: 140, 1917.

A CASE OF INTRAABDOMINAL HEMORRHAGE FROM RUPTURE OF A UTERINE VEIN DURING PREGNANCY

By Henry C. Falk, M.D.,* New York, N. Y.

I WISH to report a case of intraabdominal hemorrhage resulting from the spontaneous rupture of a uterine vein during the sixth month of pregnancy, with operation and recovery.

Mrs. I. C., age 27, was admitted to the service of Dr. Charles Hyman at the Beth David Hospital on January 25, 1929, and gave the following history: Seven hours before her admission to the hospital she rose from a chair and was seized with a sharp excruciating pain radiating from the vulva to the umbilicus along the anterior abdominal wall. She was carried to bed and soon began to complain of faintness, dizziness and blurred vision. She vomited twice before admission. Her symptoms persisted, she became dyspneic and went into a state of partial shock. Temperature 97.6, pulse 116, respirations 22. Physical examination of the lungs showed normal pulmonary resonance to percussion, breath sounds were vesicular throughout, there were no râles present. The heart was not enlarged, apex palpable in the fifth interspace within the nipple line, sounds of good quality, there was a slight systolic murmur at the base, not transmitted. Abdominal palpation revealed tenderness and slight rigidity over both lower quadrants. The uterus could be palpated extending just above the umbilicus. Fetal parts seemed prominent. Shifting dullness was elicited over both flanks. The abdomen was distended and tympanitic throughout. Vaginal examination revealed a softened cervix, admitting the finger tip, no tenderness in the culdesac, no tenderness in the fornices. Bimanual examination revealed the size and location of the fundus corresponding to abdominal palpation. Any movement of the cervix or uterus caused severe pain. On withdrawing the examining finger no evidence of free or clotted blood was seen. A blood count showed 18,200 white blood cells; polymorphonuclear leucocytes—85 per cent, mononuclear cells—15 per cent, hemoglobin 40 per cent, red blood cells 1,900,000. The urine was amber colored, specific gravity 1.017, acid in reaction, albumin negative, sugar negative, acetone negative, microscopic examination revealed a few round bladder cells, a very occasional red blood cell, no pus, no casts. The blood pressure was 96/60.

Owing to the apparent prominence of fetal parts, signs of severe hemorrhage, and the presence of fluid in the abdomen a preoperative diagnosis of spontaneous rupture of the uterus was considered, but as there was no previous history nor any condition which might have caused a weak uterine wall, it was discarded. Pre-

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mature separation of the placenta was thought of, but there was no evidence of vaginal bleeding and the symptoms indicative of possible extrauterine hemorrhage could not be overlooked. Preoperative diagnosis: intraabdominal hemorrhage, etiology unknown.

Under gas-oxygen-ether anesthesia a low midline incision was made. The peritoneal cavity was opened, the uterus drawn forward, and a large quantity of free blood found, partially clotted, filling the entire abdomen. The blood was removed and the abdomen explored for possible source of hemorrhage. The uterus looked apparently normal. The spleen was found intact, there was no sign of hemorrhage from the liver, kidneys, omentum or mesentery. Reexamination of the uterus showed on the posterior surface close to the left broad ligament, a small opening about 4 mm. in diameter. The area presented a punched-out appearance, and at its lower edge a small blood clot was found adherent. On removing this clot a small amount of blood escaped. Not recognizing the true pathology of this condition, a supravaginal hysterectomy was performed.

The patient was transfused with 800 c.c. of whole blood, Lindermann method. The patient's convalescence was normal and she left the hospital in sixteen days.

The specimen was opened and found to contain a live six months fetus which expired almost immediately. The placenta which was attached on the left side close to the fundus posteriorly was removed and showed no evidence of concealed intrauterine hemorrhage. The eroded area was probed and found to enter a collapsed, thin-walled vein. Postoperative diagnosis: Rupture of a varicose vein of the broad ligament.

These cases are extremely rare. A search of the various obstetric and gynecologic textbooks revealed no mention made of this condition as a complication of pregnancy.

Of the twelve cases reported in the literature nine represent autopsy records: Langes, Teller, Leopold, Kaufmann, Chaussier, Fritsch; two cases, those of Williams and Teller, were pelvic hematomas. Three cases, those of Miller, Halban and Modiano, were operated on and recovery ensued. In Miller's case, the preoperative diagnosis was premature separation of the normally implanted placenta with concealed hemorrhage and a classical caesarean was performed; living child, died in a few hours. In Modiano's case the preoperative diagnosis was spontaneous rupture of the uterus. A classical caesarean was performed, living child, died on fourth day. In Halban's case the preoperative diagnosis was perforation of the uterus and a vaginal hysterectomy was performed (three month pregnancy). This makes the fourth case operated on (hysterectomy) with recovery.

REFERENCES

Fritsch: Arch. f. Gynäk. 12: 407, 1877. *Langes, E.:* Zentralbl. f. Gynäk. 37: 537, 1913. *Teller:* Zentralbl. f. Gynäk. 34: 184, 1910. *Leopold:* Zentralbl. f. Gynäk. 25: 1426, 1901. *Williams:* Bull. Johns Hopkins Hosp. 15: 173, 1904. *Halban:* Monatschr. f. Geburtsh. u. Gynäk. 20: 313, 1897. *Kaufmann:* Ztschr. f. Geburtsh. u. Gynäk. 37: 201, 1897. *Chaussier:* Rev. med. chir. d. mal. d. femmes 13: 210, 1891. *Miller, James Raglan:* AM. J. OBST. & GYNEC. 16: 103, 1928. *Modiano:* Bull. de la Soc. d'obst. et gyn de Paris 18: 332, 1929.

1 WEST EIGHTY-SIXTH STREET.

HEMORRHAGE INTO HYDATID OF MORGAGNI SIMULATING ACUTE APPENDICITIS

BY ABRAHAM HEINRICH, M.D., BROOKLYN, N. Y.

(From the pathological laboratory of Brownsville and East New York Hospitals)

HYDATIDS of Morgagni, embryologic rests of the wolffian duct, are of frequent occurrence, as seen both at the operating table and in the postmortem room. To these cysts, clinical symptoms are rarely attributable. A few cases are on record wherein the cysts grew large enough to be palpated and require surgical intervention. Still more uncommon is the accident whereby torsion of the cyst occurs simulating clinically the picture of an acute abdominal disturbance. In a careful survey of the literature extant, we have been able to discover but three other reported cases, to which we should like to add one recently coming under observation.

CASE REPORT

M. S., aged fifteen, well developed and giving an irregular menstrual history. Her menses began at fourteen years of age with a duration of eight days, and for the first four times occurred every two weeks. Following that they occurred every six weeks. Her periods were accompanied by lower abdominal cramps on the first day. Her last period occurred about two months before the onset of her present illness and lasted for three days.

On the day before admission to the hospital, the patient began to complain of mild lower abdominal cramp-like pain. The pain became more intense and the next day toward evening she vomited several times. There was no constipation. Physical examination revealed definite tenderness over McBurney's point; pulse 92, respiration 26, and temperature 100.8° F. by rectum. A rectal digital examination revealed marked tenderness in the right pelvis. On admission to the hospital, her blood count was 9200 white blood cells, of which 80 per cent were polymorphonuclears. Her urine was negative.

A laparotomy was performed the same evening. Through a McBurney incision the appendix was visualized and found grossly normal. A dumb-bell-shaped black mass was found hanging from the fimbriated end of the right tube. Each half of the mass had a base of 1 cm. in diameter and was 1 cm. high and the two tips were joined by a short, narrow strand which showed one complete twist. Both ovaries were slightly cystic, the tubes were normal. The mass was ligated at its site of attachment and removed. The abdomen was closed without drainage. The patient made an uneventful recovery. On microscopic examination:

1. The appendix was found normal.
2. The cyst was lined by a single layer of very low cuboidal cells beneath which was poorly staining smooth muscle. Many necrotic vessels, some hyalinized, and groups of polys and hemorrhage were present in the wall. The contents of the cyst were composed of red cells together with an eosin staining amorphous gelatinous material.

Her next menstrual period occurred two and one-half months after her previous one, nineteen days after onset of symptoms and eighteen days postoperative, ac-

companied by severe lower abdominal cramps on the first day. The following period occurred two months later and was not accompanied by pain. Both lasted three days with moderate flow.

Andrews'[1] case was that of a woman, thirty-six years old, pregnant six months, giving a history of pain in the right lower quadrant, aggravated by fetal movements. There was no vomiting. She was comfortable for a week but tenderness was present above and within the anterior superior spine on the right side. She became distended and the pain increased in severity. Operation revealed a small purple body the size of a grape (4 cm. × 1.5 cm. and constricted in its midportion) hanging from the fimbriated end of the right tube. Both tubes and ovaries and the appendix were normal. The pathologic report revealed lymph on the surface of a thin-walled cyst filled with a blood clot.

Waters'[2] case was that of an eighteen-year-old single girl complaining of pain in the left lower quadrant with severe vomiting. Her temperature was 101°, pulse 130, 16800 white blood cells of which 86 per cent were polymorphonuclears. The menstrual cycle was of the three-week type accompanied by dysmenorrhea. She gave a history of several attacks of similar pain in the preceding nine months. She was kept under observation for five days and when operated upon, blood tinged serous fluid was found in the abdominal cavity and, hanging from the left tube by a pedicle 2.5 cm. long, and showing one complete twist, was an hydatid of Morgagni the size of an olive, about 2.5 × 2 cm. Both ovaries were cystic, the appendix was normal.

Abernethy's case[3] was that of a married woman aged thirty-three, grava iv, para iii, who gave a history suggestive of an incomplete abortion following a two months' period of amenorrhea. She then had pain in her right lower quadrant with vomiting for three days. Her temperature was 99.4° F., her pulse was 80. A ''dilatation and curettage'' and a laparotomy was performed with the following findings: (1) Products of conception. (2) An old chronic appendicitis. (3) A hydatid of Morgagni 2 cm. × 7 × 7 cm. hanging from the right tube, reniform in shape and showing two twists. The serosal lining was thick and lusterless. A smaller cyst was present on the left side. (4) Bilateral small ovarian cysts.

In an analysis of the few recorded cases, the age incidence in both Waters' and our cases fell in the second decade. Both are single adolescent girls. Andrews' and Abernethy's cases occurred in married pregnant women in their ''thirties.''

The menstrual history was not given in Andrews' or in Abernethy's cases. Waters' and our cases gave very irregular menstrual histories.

Waters' case had pain in the left lower quadrant. There was no radiation of the pain in any of the cases. Andrews' patient did not vomit, the other three did. The temperature and pulse were variable from 101°, pulse 130 to 99.4°, pulse 80. Andrews' does not give the pulse nor temperature. The blood count of Waters' case was 16800, 86 per cent polys, ours was 9200, 80 per cent polys. The other two are not given.

Waters' case had a twisted hemorrhagic hydatid of Morgagni hanging from the left tube, the three others were hanging from the right tube. Abernethy's case had a chronic appendix. All the other three had

normal appendices. The ovaries of Andrews' case were normal. The ovaries of the other three were cystic. Waters' case had a pedicle 2.5 cm. long and twisted twice. The other three had no pedicle. Andrews' was constricted in the midportion. Abernethy's was reniform and had two distinct twists. Ours was dumb-bell shaped and had one complete twist.

SUMMARY

These cases illustrate the similarity of the clinical picture of twisted hemorrhagic hydatid of Morgagni to that of an acute appendiceal lesion. The former however gives a history of a menstrual irregularity and dysmenorrhea (our attack occurred before the onset of menstruation), with only a few of the signs of an acute abdomen.

REFERENCES

(1) *Andrews:* J. Obst. & Gynec. (Brit. Emp.) 22: 220, 1912. (2) *Waters:* J. A. M. A. 72: 1072, 1919. (3) *Abernethy:* Brit. M. J. 1: 144, 1929.

4600 FOURTEENTH AVENUE.

A CASE OF CHRONIC MENORRHAGIA CURED BY GALVANIC DILATATION AND ZINC CHLORIDE IONIZATION*

BY VICTOR C. PEDERSEN, A.M., M.D., F.A.C.S., NEW YORK, N. Y.

A. M., U. S. A., white, twenty-seven years old, married, housewife, first seen February 22, 1926.

Diagnosis.—Chronic relapsing menorrhagia complicated by nongonococcal acute vulvovaginitis and acute vulvovaginal abscess.

General health and habits good. Constipation moderate. Venereal history negative.

Menstruation began at fourteen, no pain, but irregularity and excess great, so that flow appears at unknown intervals and sometimes continues for two or three weeks until going to bed stops it. For about seven years, therefore, she has been a victim of easy chair or bed life many months in the year and for long periods of those months. One of the mysteries of this case is how she compensated for this loss of blood and strain on the nervous system. When I first saw her she was and remained a rosy cheeked, quietly disposed, attractive girl.

Another mystery is how this girl ever considered herself marriageable in the face of such an infirmity. She did not let her fianeé know anything about it until after marriage.

Her sexual instincts and their gratification are normal, except for their early marital excesses as hereinafter stated.

Her present sexual history is very instructive. She is the wife of M.P.M., whose first and divorced wife also had a double standard consisting in practical absence of sexual instinct and denial of nearly all sexual intercourse.

The usual result followed. The husband was compelled to practice his own double standard, and acquired gonorrhea.

Marriage was permitted only after six months of freedom from all symptoms and after many smear, culture, and seven glass tests were consistently negative for the gonococcus or other pathogenic organisms. The marriage occurred thirty-nine months after the treatment stopped, during which time he remained free of subjective and objective symptoms. His last test was a short time before marriage according to my advice and custom.

Intercourse was excessive to a very high degree. Lysol douches were used as contraceptives and although weak, induced a purulent vulvovaginitis in a few days followed by abscess of the left vulvovaginal gland.

The bacteriologic investigation was by smears and cultures from the urethra, vulvovaginal gland outlets and vulva as a whole, posterior culdesac of the vagina, and the cervix. Its findings were negative for the gonococcus, positive for the bacillus coli, diphtheroid group, and many pus cells. Many nonspecific bacilli were found.

The behavior of the discharge was that of gonococcal infection except the color, odor, and consistency of the pus. The patient admits the peculiar habit of wiping herself after defecation toward the vagina instead of away from it. This fact probably introduced the bacillus coli into the vulva and vagina as a complicating infection. Careful instructions were given to avoid this infection.

The specimens were taken by pressing the swab to squeeze mucus out of the glands. This detail seems to be neglected because in my work for one of the institutions for unmarried mothers I have regularly found positive smears from time to time in young women coming from nearly every hospital in Greater New York, with reports negative for the gonococcus. Moreover, the four anatomical points I have named do not seem to be systematically examined by taking an original and a control specimen. Too much caution cannot be exercised.

The treatment was at first against the infection and next against the chronic menorrhagia.

Normal salt solution douches were substituted for the lysol, four times a day as hot as tolerable and as a contraceptive. Office douches of 1 in 8000 slowly ascending to 1 in 4000 formalin were given to kill off the bacillus coli, which occurred in about three weeks. The vulvovaginal abscess was at first treated with 10 per cent ichthyol salve but was finally lanced and evacuated of 30 c.c. of bloody pus. It healed, leaving only a small node, in about three weeks.

The disappearance of pus in about sixty days permitted attention to the uterus.

As a means of hemostasis and ovarian control two roentgen-ray treatments were given 60 milliampere minutes each, from the static machine, with a tube backing up a 5″ spark gap. The distance was 8 inches. The filter was ⅜″ sole leather and 3 mm. of aluminum. First one ovarian region then the other was rayed, including the uterus each time. At the end of all treatment one more x-ray treatment was given. Radiant light followed the x-ray (one visit later from field to field) to protect the skin.

As a means of restoring the pelvic circulation to balance, diathermy was tried ranging from 500 to 1500 M.A. employing 8 inch by 10 inch electrodes beneath the buttocks and over the pubes. Contrary to expectations this very mild current seemed to excite the bleeding. It was not repeated. It should be remembered that such a current between such large electrodes is mild. In this case the patient perceived a gentle warmth. The actinic influences (though not felt by the patient) are more important than the warmth noticed by the patient.

Galvanic dilatation of the cervix for drainage up to ⅜ inch with the negative pole in the cervix and distributing plates on the buttocks and pubes (and well lapped upon the sides) was employed. Next the cavity of the uterus was packed with fine gauze strips soaked in 10 per cent chloride of zinc solution tied to the

vaginal packing, retained twenty-four hours or less, then removed by the patient and normal salt solution vaginal douches employed.

The zinc chloride packings were used once a month. The galvanic dilatation was also a zinc ionization and repeated every four, seven, and fourteen days. After the cervix had dilated and relaxed under the negative pole the polarity was changed to positive for five minutes so that zinc ionization would occur. In order to avoid adhesion to the positive electrode, the polarity was again changed to negative for about five minutes. All these currents were very mild, never above 10 M.A., and always comfortable to the patient. Zinc chloride 10 per cent was applied to erosions of the cervix at each visit, with benefit.

Improvement in the discharge began with the fifth galvanic treatment (within eleven days). The bleeding from the uterus also decreased. The treatment was continued from May 10 to September 29 at increased intervals up to once in about fourteen days. There were only three visits in September, 1926.

She was next seen in December, 1926, examined, found in good condition. One dilatation treatment was given.

In March, 1927, she called to report a slight relapse. This was certainly due to very unreasonably excessive intercourse which was immediately forbidden on the ground that such sexual strain would reinduce the ovarian and uterine functional disorder. One dilatation with zinc ionization was given followed by static wave current to the uterus to compel its return to tonicity. This treatment was efficient the sufficient because she did not return until September, 1927, with this report: discharge moderate, no napkin used, no stains on clothing. In fact she was free from discharge until three weeks previously when slight relapse occurred, ranging from few streaks to enough to annoy. Menses normal within the average for all women. Coitus normal in frequency and without pain. Contraceptives: normal salt solution douches only. At examination normal in all respects. Discharge a typical, simple, moderate leucorrhea.

Last seen June 20, 1929, about three years after beginning treatment. Menses nearly painless, normal quantity and duration, nearly normal intervals. At times has flowed for about one week. Leucorrhea present but not severe. Coitus about 2 times per week, not painful. The vulva and vagina were clean. Cervix was very slightly eroded. Uterus soft.

On account of the erosions and softening another course of treatment was begun. Only two dilatations and zinc ionizations seem to have relieved the status.

The couple was warned that a functional disorder of at least seven years' standing must leave behind it a definitely weak spot anatomically and physiologically speaking, which will respond by relapses to such causes as exposure to cold and wet, bodily strain as in long automobile rides, excessive intercourse and wrong douches in terms of temperature and chemical substances. Advice to omit all contraceptives, reduce intercourse to once in seven to ten days, invite and accept pregnancy as the best possible physiologic cure has so far been ignored and probably will be ignored.

CONCLUSIONS

1. Good health maintained for seven years during such loss of blood as this woman had is rare.

2. The prompt incidence and the consistent progress of benefit by electrotherapeutic means need hardly more than mention to be impressive and convincing.

3. One leading gynecologist of this city has already admitted to one of my colleagues in electrotherapy that he should do more office work with physical measures and less operative treatment.

4. When the value of physical measures becomes common property many operations now being done will be refused, as they should be refused, at least until said measures shall have been skillfully and perseveringly tried and failed.

5. This patient was cured without the costs of absence from home duties, of hospitalization, of surgical and nursing fees and without the risks of anesthesia and operation. Results of this kind are not medical curiosities but rather common experiences in skilled hands.

45 WEST NINTH STREET.

A RACHITIC NAEGELE TYPE PELVIS WITH FAULTY INCLINATION AND MARKED SPINAL DEFORMITY*

By J. BAY JACOBS, M.D., F.A.C.S., WASHINGTON, D. C.

(Associate Clinical Professor of Obstetrics, Georgetown University)

A COLORED woman, gravida i, twenty-three years of age, was first seen in the prenatal clinic of Georgetown University Hospital, September 10, 1928. Although her gait was normal, the unusual prominence of her buttocks attracted attention. Examination of her back in the standing posture showed the depression denoting the right sacroiliac synchondrosis to be about 1½ inches higher than the left. · A lumbar lordosis with a left scoliosis was very evident. A marked right scoliosis of the dorsal vertebrae and a compensatory left scoliosis of the upper dorsal and cervical vertebrae was noted. The external pelvic diameters were as follows: Interspinous 26, intercristal 23, external conjugate 15.5, right oblique, 18.5, left oblique 20+.

With the aid of my obstetric inclinometer, it was found that the symphysis was 6 cm. high, the diagonal conjugate 9 cm. long, with the promontory located to the left of the midline. Conjugate of outlet was 8.5 cm. and bituberal diameter 10.5 cm., calculated true conjugate 8.5 cm. Diagnosis of Naegele type rachitic pelvis with spinal deformity. Although the left oblique diameter was larger than the right, a favorable prognosis was predicted, should the patient have a small baby and the head select the right oblique diameter, especially as an R.O.P., because of the situation of the promontory on the left side. The brim appeared flattened on the left side, which further tended to diminish the available space at that half of the inlet.

Usual prenatal care was given and at 11 P.M. March 5, 1929, patient entered hospital in labor. Examination two hours later revealed fundus at ensiform with small parts in R.U.Q., head floating and F. H. 145 to the left and above the navel. An attempt at manipulating the abdomen in order to rotate the occiput to the right side was unsuccessful. After twenty-four hours of labor with no engagement, a transperitoneal cesarean section was done. Before closing the abdomen the true conjugate was measured directly with an accurate scale, and found to be 8.5 cm. The living male child weighed 5 pounds, 9 ounces.

Postpartum hemorrhage occurred six hours after operation and the husband who was informed of the urgent need of transfusion, refused to obtain a professional donor until the next day when the patient was moribund. Death occurred and at postmortem examination there was no blood found in the peritoneal cavity

*Demonstrated before the Georgetown Clinical Society April 17, 1930.

and the pelvic organs were negative. The pelvis and part of the spinal column were removed as shown.

DESCRIPTION OF SPECIMEN

The pelvic inlet is flattened on the left side anteriorly, the right sacrocotyloid diameter measuring 8 cm. and the left 6.75 cm. The distance from the center of the promontory to the right sacro-iliac synchondrosis is 6 cm.; the corresponding measurement to the left is 5 cm. The distance from the promontory to the middle
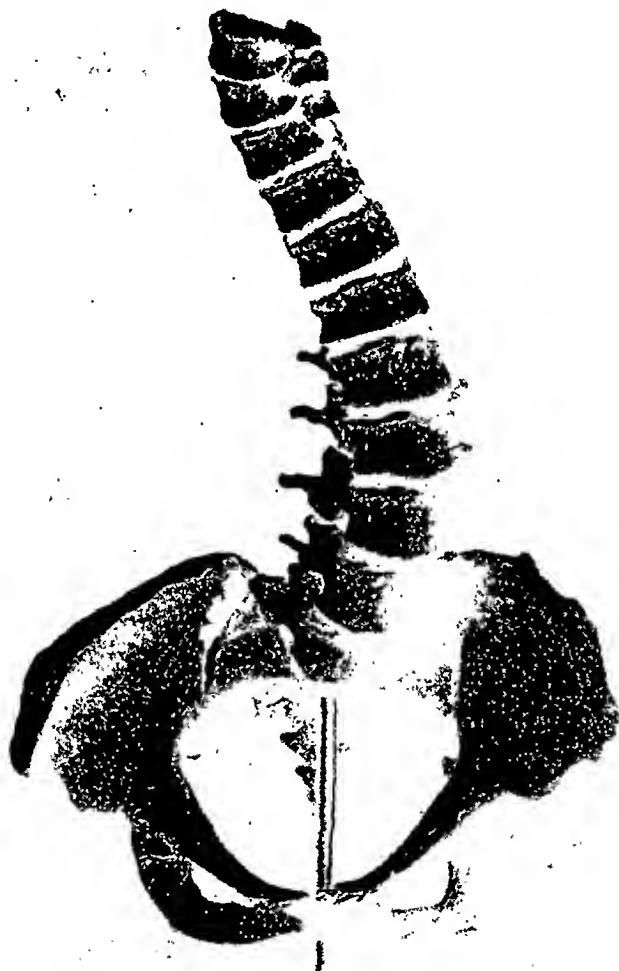
Fig. 1.—Anterior View. Shows flattening of left side of brim and faulty inclination. Interspinous diameter is greater than intercristal and iliac fossae look forward. The anterior surfaces of the lumbar vertebrae are directed toward the left and the dorsal are directed toward the right. Lumbar lordosis evident. Left sacral ala is smaller than the right.

of the upper border of the symphysis which with the aid of the inclinometer was found to be 8.5 cm., measures 8.25 cm. on the dried specimen. The diameter from the promontory to the inner margin of the upper border of the symphysis measures 7.7 cm. The left oblique of the superior strait is 10.5 cm. and the right oblique 9.75 cm. Although the left sacral ala is smaller than the right it is well formed, and the articulation with the iliac bone is normal. The entire pelvis is rotated on a transverse axis running through the sacroiliac synchondroses, and the habitual inclination is almost 90 degrees, for the inlet is practically perpendicular to the

horizon. The iliac bones as shown in Fig. 1 are not symmetrical, the crest of the right one extending outward about 1.25 cm. more than the left. The interspinous diameter measures 25 cm. and the intercristal 23 cm. The iliac fossae look almost directly forward.

Inspection of the posterior aspect affords an excellent view of the outlet. The arch is extremely wide and shallow, the anterior sagittal measuring 4.25 cm. and the transverse of the outlet well over 11 cm. The left pubic ramus is smaller than the right and the edges of both are markedly everted. The left ischial spine
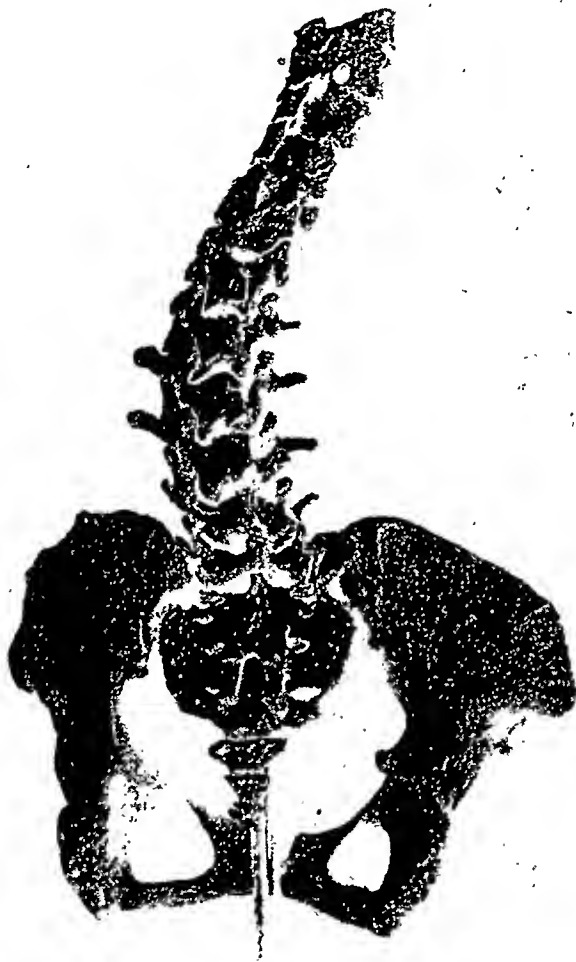
Fig. 2.—Posterior View. Shows position of sacrum, the wide shallow arch and rotation of entire pelvis on a transverse axis running through the sacro-iliac synchondroses. The transverse processes vary in size.

is larger and thicker than the right. The internal surface of the sacrum looks directly downward and the posterior surface almost directly upward, the sacro-coccygeal joint being situated 8.25 cm. behind an imaginary perpendicular line running through the posterior margin of the upper border of the sacrum. The distance of the posterior superior spine of the right iliac bone to the posterior surface of the sacrum measures 2.5 cm., the corresponding one on the left measuring 3.2 cm. The sacral foramina are irregular in size and shape.

The vertebral column was mounted in its normal attitude, the spinal curvatures being clearly shown in the illustrations. There is a marked lumbar lordosis,

especially of the last two lumbar vertebrae, with a left scoliosis. These vertebrae appear to be rotated on a vertical axis so that the anterior surfaces are directed toward the left. In the dorsal region there is a scoliosis to the right, with a marked rotation of the vertebrae, so that their anterior surfaces look toward the right. On all the vertebrae and in each individual bone, the transverse processes vary in size and thickness. The lordosis and the unusual position of sacrum are well shown in a lateral view.

Fig. 3.—Anterolateral View. Showing marked lumbar lordosis, the rotation of bodies of vertebrae on their vertical axes, and the unusual relation of the pelvis to the spinal column.

CONCLUSION

In this particular case there was no marked disproportion between the inlet and the fetal skull. The lumbar lordosis besides limiting greatly the available area at the inlet, would direct the presenting part over the upper border of the symphysis instead of into the pelvis. It would be impossible for the birth object to round this great curve and enter an inlet of such faulty inclination.

CHASTLETON HOTEL.

MONO-AMNIOTIC TWINS WITH TWISTED CORDS*

By Tiffany J. Williams, M.D., Great Falls, Mont.

(From the Division of Obstetrics and Gynecology of the Great Falls Clinic)

THE infrequency of reported cases of mono-amniotic twins with twists and knots of the two cords, would seem to justify a report of the following case.

Mrs. J. Z., aged thirty, had previously had two full-term normal pregnancies and one miscarriage at three months. The previous menstrual history was normal and of the regular twenty-eight day type. There had been no past serious illnesses or operations.

The last menstrual period occurred on Nov. 15, 1928, since which time there had been no nausea or vomiting although occasional frontal headaches had been present. Fetal movements were noticed from April until July 1, 1929 when the movements ceased. On July 9, 1929 the patient was referred to the Deaconess Hospital after having been told by the attending physician that the baby was dead.

Fig. 1.—Photograph of the placenta and the knotted cords from a case of mono-amniotic twins.

The general physical examination on admission revealed essentially normal findings. Abdominal examination showed the fundus of the uterus to be about nine cm. above the umbilicus. The uterus was tensely distended by an excess of amniotic fluid so that no fetal parts could be palpated and the fetal heart could not be heard. The urine examination was normal, blood pressure was 120/80, and the blood Wassermann test was later reported as negative.

Labor began spontaneously on July 9, 1929, and after four hours of labor pains, the cervix was fully dilated. The membranes were ruptured artificially, and a still-born macerated female infant was born spontaneously ten minutes later. The cord of this infant was stretched so tightly that it had to be clamped before the body could be completely delivered. Examination revealed the presence of a second infant, and ten minutes later, another macerated female child was born without difficulty. Immediately following the birth of the second child a knot of cords approximately the size of a man's fist escaped from the vagina. The placenta separated spontaneously and was expressed intact from the vagina a few minutes later.

Both infants were macerated females, weighing 1750 gm. and 1825 gm. respectively. The placenta weighed 650 gm. and measured 22 cm. × 17 cm. × 3 cm. The cords, which were 6 cm. apart, were eccentrically inserted, one 3 cm. and the other 4 cm. from the edge of the placenta. There was an anastomosis of the

vessels of the two cords on the fetal surface of the placenta. The membranes were ruptured 6 cm. from the edge of the placenta and consisted of a single chorion and a single amnion. No evidence of the remains of an amniotic partition could be found.

At a distance of 15 cm. from the placenta the two cords were twisted and looped tightly around each other, forming a knotted mass the size of a man's fist. The cords were of a dark hemorrhagic color and measured in length 45 and 52 cm. respectively.

DISCUSSION

The present case is undoubtedly one of mono-amniotic twins, in whom the cords were twisted and looped around one another tightly enough to occlude the circulation in both cords, resulting in the death and premature delivery of both babies.

Sonntag in 1905 collected 23 cases of mono-amniotic twins from the literature and discussed the etiologic theories of their production. There are in general two theories advanced to explain the production of single amnion twins, either two amnions originally develop, and, as a result of a tear in the adjacent amnions, the cavities are united, the torn partition being subsequently absorbed, or it is assumed that two embryonal areas develop in close proximity, so that one amnion may encircle both embryos. Dancing, horseback riding, vomiting, and falling, as well as hydramnios and excessive length of the cords have been considered as predisposing causes for the looping and twisting of the two cords.

In examining the literature I have been able to find additional cases reported by Plitz, Pallin (2 cases), Roberg, Vallois L., and Vallois H., Dietrich, and Abrams, making a total, including the present case, of 31 reported cases.

REFERENCES

(1) *Sonntag, F. P.:* Inaugural Dissertation, Leipz, 1905. (2) *Plitz, W.:* Zentralbl. f. Gynäk. 31: 38, 1907. (3) *Pallin, G.:* Obstetrique, Par. 14: 47, 1909. (4) *Roberg, F. E.:* Trans. Chicago Path. Soc. 8: 83, 1910. (5) *Vallois, L., and Vallois, H.:* Bull. et. Mem. Soc. d'anthrop. de Par. 4: 213, 1913. (6) *Dietrich, S.:* Zentralbl. f. Gynäk. 38: 586, 1914. (7) *Abrams, S. F.:* AM. J. OBST. & GYNEC. 1: 955, 1920.

A CASE OF UTERUS UNICORNIS WITH RUDIMENTARY LEFT UTERUS AND RIGHT ECTOPIC PREGNANCY

By Dean W. Hart, M.D., St. Johns, Mich.

THIS case is of interest because ectopic pregnancy occurred in a pelvis also containing a rare form of uterine anomaly. Reading of the following history and physical examination records makes further comment unnecessary about the value of thoroughness in examination and history taking.

Mrs. A. M., a patient of Dr. Frost C. Buchtel, August 17, 1929. The father is one of fourteen children, all his married sisters having normal children. Two unmarried sisters are apparently normal. The maternal grandmother is one of twelve children. The mother has one brother and one sister, both of whom have children who are apparently normal. Fifteen years ago the mother had a hysterectomy, laboratory report being sarcoma, but she is healthy today. No pelvic abnormalities were noted. The mother's first child was a premature macerated stillbirth. Her second child, also prematurely stillborn, had one clubfoot and hydrocephalus. Her third child was also stillborn, but was apparently normal. The patient is the fourth child and there was a healthy son later.

The patient is twenty-five years old, married eighteen months, with normal sex life.

Her only serious illness was rheumatic fever at ten years of age.

At the age of thirteen she menstruated once. A year later her periods started again and have remained normal and regular through June 25, 1929.

Chief Complaints.—Abnormal vaginal bleeding; nausea and vomiting; pain in right lower quadrant.

On July 4, she began to have excessive vaginal bleeding which lasted three weeks accompanied by almost continued nausea and vomiting, right lower abdominal aching and colicky pain. After several days of relief, the symptoms returned. At this time the vomiting attack was followed by distention. She noticed a painful lump in one breast. She was studied by three New York City doctors during this time, all of whom diagnosed the trouble appendicitis. No vaginal examinations were made, but there were many blood examinations. During a second intermission of symptoms, the patient started for Denver, becoming ill again on the train. One attack of pain was so severe that she fainted. There have been no chills or fever, and no symptoms referable to lungs, heart, kidneys or gastrointestinal tract.

Examination.—The patient was markedly pale and weak. In the abdomen there was tenderness over the appendix. No rigidity, distention, or masses were noted. The vaginal examination disclosed an enlarged and tender right tube. The right ovary was also enlarged. Left adnexa were negative. The uterus was in the axis of the vagina, was normal in size and was, perhaps, a little softer than normal.

Laboratory Findings.—Leucocytes, 9,200; Hb, 82 per cent; red cells, 4,080,000. Urine was negative.

Diagnosis.—Probably right extrauterine pregnancy. Postoperative diagnosis: Same.

Operation.—Low midline incision; abdominal cavity contained nearly a quart of bloody fluid and clots. The right tube was enlarged and the point of rupture was about an inch from the proximal end. The right ovary was normal. It was then discovered that there was an absence of the left uterine cornu. However, lying

between the layers of the broad ligament, three inches to the left of the uterus, was found a symmetrical oval-shaped rudimentary uterus the size of an English walnut. Embedded in the left lateral wall of this uterine body was the normal left ovary, and adherent to this was one-half inch of the fimbriated end of the left tube. The normal left round ligament was attached to this rudimentary uterus. After careful examination no connection was found either between the fimbriated end of the left tube and the rudimentary uterus or between the rudimentary uterus and the main uterus or vagina. This anomalous condition was left intact because removal of the extra uterus would have endangered the blood supply of the ovary. After removal of the right tube and the appendix the incision was closed. The convalescence was uneventful.

It would appear that this anomaly resulted from nondevelopment of the lower half of the left muellerian duct with complete failure of fusion of the muellerian ducts. Since there was no actual connection between the rudimentary uterus and rudimentary end of the oviduct, there must have been also a failure in development of the midpart of the upper third of the left muellerian duct. The left ovarian ligament was absent, but the position of the ovary with the rudimentary uterus in-
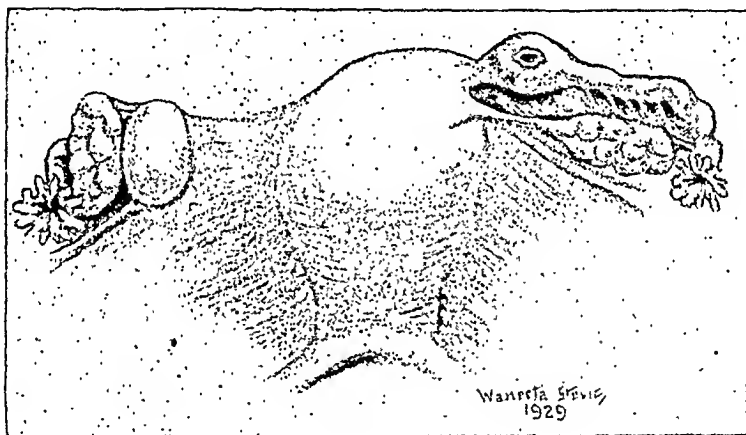
Fig. 1.

dicated that its original function of bringing the ovary into the pelvis was fulfilled.

Although a careful search of the literature available has been made, no example of this anomaly has been found. Neither has the title of any unavailable English article a suggestion that it presents such a case.

Hill and Newton both reported cases in which there was a perfectly formed rudimentary uterus lying in the broad ligament, but which had a small fibrous cord running out along the lateral pelvic wall to connect with the normal uterus at the cervix or even connecting with the vagina. Hill says that such a fibrous band may be so small as to escape macroscopic notice during life. However, he neither gives a bibliography nor cites cases in which this has occurred. Furthermore, the anomaly under discussion was not at all a perfectly formed rudimentary uterus.

A case mentioned by Fromell, of Germany, in 1890 was similar. The only difference was that there was also a rudimentary horn in normal position which had a blind end a short distance from the uterus.

In reading literature on anomalous uteri, it is interesting to notice that a great number of titles of American articles fail to signify much about the context. The foreign articles are, as a rule, better named.

SUMMARY

In this case a complete physical examination in conjunction with a carefully taken history of the present illness, made possible a correct preoperative diagnosis of ectopic pregnancy, although three surgeons had previously diagnosed appendicitis, having neglected to make a vaginal examination. The anomaly, however, was not recognized preoperatively. The rudimentary uterus, three inches to the left side of the normally situated uterus was interpreted as the left ovary. This failure well illustrates the extreme difficulty of making an absolutely correct preoperative diagnosis in a pelvic or abdominal case.

The anomaly found was uterus unicornis with a small left-sided rudimentary uterus. No case identically the same was found in the literature.

204 WEST STATE STREET.

REFERENCES

Graves: Gynecology, ed. 3, W. B. Saunders Co., Philadelphia, pp. 470-478. *Piersol:* Anatomy, J. B. Lippincott, Philadelphia, p. 2038. Reprints of Gynecology Dept., Johns Hopkins Hospital & University, vol. B, Chap. 2; vol. X, p. 41. *Hill:* Am. J. Obst. 47: 31, 1903. *Newton:* Ann. Surg. 79: 105, 1924. *Fromell:* München. med. Wchnschr., No. 15, April 15, 1890, p. 263.

PREGNANCY IN UTERUS BICORNIS UNICOLLIS WITH THE CHILD OCCUPYING ONE HORN AND THE PLACENTAL SITE A PORTION OF BOTH

BY WILLIAM A. MICHAEL, M.D., PEORIA, ILL.

THIS case is reported because it presents a number of features commonly associated with pregnancy and labor complicated by bicornate uterus, together with a rather unusual feature, namely, the attachment of the placenta at the juncture of the two horns so that the placental site occupied a portion of both. Prior to labor, findings were insufficient to justify more than a probable diagnosis of bicornate uterus, and the true condition remained unrecognized until the interior of the uterus was explored attending placental removal.

Case Report.—Mrs. A. L., white, aged thirty-five, presented herself two years ago for investigation of sterility. She had never been seriously ill, and had had no operations. Her menstrual periods had been normal since onset at fourteen years, and although married for ten years, she had never conceived. Owing to retrocession it was not possible to palpate the uterus in its entirety, but otherwise no abnormalities were disclosed, and she was, from a general standpoint, physically fit. The Huhner test proved normal, but in performance of the Rubin test, gas failed to pass at 200 mm. of Hg. A later tubal insufflation, to be followed by a hysterogram, was advised, but was indefinitely deferred by the patient.

She again came under observation on July 16, 1929, her latest menstrual period having occurred on May 30, 1929. At this time it was impossible to outline the corpus, but the softened cervix and lower segment, together with the subjective symptoms, left little doubt as to the existence of pregnancy. Examination on September 3, 1929, showed the uterus nicely forward, size of ten to twelve weeks, and no apparent abnormality. Except for "spotting" on June 27 to 30, rather free bleeding for twelve hours, without pain, on October 25, and slight bleeding on November 11, 1929, the pregnancy pursued a normal course.

On January 9, 1930, eight weeks in advance of expectancy, the membranes ruptured without warning, and the patient entered the hospital. There was an unusual broadness of the fundus without demonstrable notch between the two sides and without torsion. A fetal pole, which on rectal examination was considered cephalic, presented in upper pelvis. That the deformity of the fundus was due to myoma was considered highly improbable owing to earlier observation. This left fetal or uterine malformation for consideration, and the former was definitely excluded by x-ray which revealed the breech presenting in L.S.A., but failed to explain the broadening of the fundus.

Labor set in ten days later and pursued a slow, tedious course; the contractions were weak and ineffectual, and eventually required the administration of morphine and chloral for periods of rest, on two occasions. The fetal heart tones remained regular throughout, at a rate between 130 and 140. After cervical

Fig. 1.—Hysterogram showing uterus bicornis unicollis and right tubal patency. The area between points *A* and *B* indicates, relatively, the former placental site.

effacement, as followed by rectal palpation, was finally accomplished, a hydrostatic bag was inserted, and dilatation secured in a few hours. Following expulsion of the bag, the breech was spontaneously born and extraction was made without difficulty.

After delivery, the fundus showed a distinct notch which divided the uterus into a large left portion and a lesser right, the latter being approximately 15 cm. across. In the usual period of time there were no signs of placental separation, and efforts at expression were unavailing. The Mojon-Gabaston method of umbilical vein injection with saline was tried without effect. Invasion of the uterus, after the membranes had been ruptured for so long a period, for the manual removal of the placenta admittedly entailed a considerable risk, yet the deformity of the uterus and the prematurity of the labor seemed somewhat against normal separation, and certainly, later removal would be extremely hazardous. Accordingly, two hours after delivery, the placenta was manually removed without difficulty and without unusual hemorrhage. The following condition was noted: In the region

of the right horn, a distinct ring-like aperture, 6 to 7 cm. in diameter, was encountered leading into a secondary pouch of approximately 10 to 12 cm. in diameter. The wall of this pouch was distinctly thinner and more flaccid than that of the uterus proper, and the placental attachment extended partially into it. Twelve and twenty-four hours later, the fundal irregularity was still demonstrable, thus excluding contraction ring. Convalescence was without untoward incident.

On February 26, 1930, bimanual examination was made, but as in examinations previous to conception, it was not possible to bring the corpus uteri between the examining fingers, and the palpatory findings were, consequently, indeterminate. However, on May 12, 1930, a hysterogram was made which showed definitely the bicornate nature of the uterus, and patency of the right tube.

800 PEORIA LIFE BUILDING.

HEMIPLEGIA COMPLICATING PREGNANCY

By Percy A. Perkins, M.D., F.A.C.S., Memphis, Tenn.
(Obstetrical Service, Methodist Hospital)

HEMIPLEGIA occurring during pregnancy is exceedingly rare. A search of the literature on this subject, dating back to the age of Hippocrates, revealed reports of only 43 cases. One of the best and most complete of these articles was contributed by Talley in 1924, at which time he was able to collect only 36 cases from the literature. In 1929 Scott's review of literature, including his own case, showed a total of 43 cases.

The paramount questions with which we were confronted in this case I am reporting were: what kind of brain lesion were we dealing with, and was toxemia a predisposing factor?

Mrs. J. E. C., para ii, aged 22, seven months pregnant, admitted to the hospital December 15, 1929. Her family history was negative. She gave a history of always having been healthy except that about three months before she had malaria and took ten grains of quinine daily for several weeks. Menstrual history normal. Last pregnancy and labor two years ago, normal except that she had some kidney trouble for a short while afterward. A few days before coming to the hospital she began to feel sleepy, dizzy, and a little nauseated. She had been on a milk diet for several days before admission to hospital.

On admission temperature was 98.6° F., pulse 94, blood pressure 104/68. She was complaining of dizziness, double vision, and nausea. Urine showed a faint trace of albumin and one or two pus cells. Total R. B. C. was 4,000,000, total W. B. C. 11,800, 81 per cent polys, urea nitrogen 14.5 per 100 c.c., negative Kahn test. Thompson, of the medical service, examined her and found her heart and lungs normal. His opinion was that this was a case of preeclamptic toxemia.

The following day her nervous condition was worse; she was mentally confused and disorientated. Blood pressure was 132/90, pulse 90, temperature normal, urine negative for albumin but showed four-plus acetone, CO_2 combining power 48.6 per 100 c.c. Dr. Ayres, of the obstetrical service, saw her in consultation and stated that she impressed him as a toxemic and advised a termination of pregnancy. During the next thirty-six hours she became worse, having delusions, seeing imaginary objects, and talking of killing some one. She was very noisy and hard to keep in bed. Chloral and bromides were not effective in controlling her, and it was necessary to add morphine. Pulse was 130. Labor was induced by bougie and packing; normal delivery twenty-two hours later of a normal five pound baby that died suddenly three hours later. About six hours after delivery the patient seemed to be in a stupor,

and there was a paralysis of the right leg, right arm, and right side of face. Pulse was 90, temperature 101° F., blood pressure 118/75. Apparently there was some pain when the right arm was moved or when pressure was made over left side of neck. Spinal puncture showed no increase in pressure. Many R. B. C., sugar 66 mg. to 100 c.c., cell count 30, but inaccurate on account of blood. Dr. Anthony examined her nose, throat, ears, and visual fields and reported them normal. Spinal puncture was repeated daily for four consecutive days and each showed blood present. Culture was negative. December 28 her condition was greatly improved, paralysis had disappeared, she had only occasional headache and was a little restless. Blood pressure 122/75, temperature 98° F., pulse 90. January 1 she was discharged. Her mind was clear, no paralysis was present, no headache.

Bunting, neurologist, saw her on several occasions and made the following report: "My examination of patient disclosed the following: patient in a delirium of combative maniac type. A right hemiplegia, complete, inclusive of right frontalis muscle. The spinal puncture disclosed a blood-tinged fluid—evenly tinged and which continued the even red color throughout the withdrawal of some 15 to 20 c.c. of fluid. The deep reflexes were less active on right. There was no Babinski or Oppenheim. Her speech on twenty-second or twenty-third showed a sensory-motor aphasia. Impression, a meningeal hemorrhage of left side which was probably helped by the frequent spinal drainages."

January 29 she came to my office, feeling fine, gaining weight, occasional pain in top of head. Urine was negative. Heart normal. X-ray of head negative. Blood pressure 125/85.

CONCLUSIONS

In my opinion this was a hemiplegia caused by a hemorrhage, probably meningeal. I also think that her symptoms were sufficient to justify us in the beginning to make a working diagnosis of preeclamptic toxemia. Even though the blood pressure was low, only a faint trace of albumin was found on two occasions and acetone once.

In view of the fact that we were unable to find any evidence of endocarditis, thrombophlebitis or any foci of infection, I conclude that there was some close association between her hemiplegia and toxemia and that possibly the hemiplegia was indirectly caused by, or the result of the toxemia.

528 MEDICAL ARTS BUILDING.

A CASE OF PREGNANCY COMPLICATED BY MULTIPLE FIBROIDS OF THE UTERUS

Cesarean Section and Hysterectomy, With Child and Mother Surviving

By John Joseph Gill, M.D., F.A.C.S., Chicago, Ill.

IT IS not an uncommon occurrence to find a fibroid uterus retaining a pregnancy, but the case which I wish to present developed unusual features which are of sufficient interest to warrant its report.

On May 26, 1929, I was called to the home of Mrs. F., an American negress, who had for several months been under the care of a physician for dropsy. She had a marked generalized edema and the abdomen was enormously distended with fluid, blood pressure 180/150. She complained of blurred vision and epigastric pains. The urine was loaded with granular casts and albumin. She was thirty-eight years old and had been married fifteen years. She had not menstruated for six months, previous to which time her periods had been normal and regular; she had never before been pregnant and gave no history of venereal disease. The Wassermann reaction was negative, but smears from the vaginal glands were positive for gonococci.

Examination revealed a very large uterus with numerous large and small fibroids and a fetus of about six months' development.

Tincture of digitalis and magnesium sulphate were given in large doses, together with rest in bed and a regulated diet. The anasarca rapidly disappeared and general improvement became noticeable; blood pressure became gradually reduced and on June 29 registered 130/75. At this time, labor pains developed and the membranes ruptured. She entered the hospital but refused operative help for forty-eight hours.

On July 1, a midline abdominal incision was made. The panniculus was very edematous and about two liters of fluid was removed from the peritoneal cavity. The uterus was incised and a four-pound baby girl removed. The broad ligaments were clamped and a supravaginal hysterectomy performed, leaving the placenta intact. The mother and child progressed well and went home on the twenty-first day, postpartum. However, a few days later infection developed in the line of incision and a sinus persisted for ten weeks, when a tape end appeared at the surface and could not be removed. On September 16 she entered the hospital and under local anesthesia, a large laparotomy pad was removed. The sinus closed rapidly and the woman made a complete recovery. The baby at six months is doing well and weighs eight pounds.

Dr. Steward L. Vaughan, Pathologist, describes the uterus removed as follows:

The specimen is a uterus containing multiple fibroids which are chiefly subserous and intramural. The entire mass weighs 2382 gm., is roughly globular in shape and measures about 22 x 12 cm. in its largest diameters. The uterus is partially involuted, has a wall with an average thickness of 1½ cm. and the cavity is entirely filled with placenta. The umbilical cord appears normal. The diameter of the cervical canal at the internal os is 2¼ cm. and the uterus was amputated at this point.

On the anterior superior surface of the uterus is a fibroid measuring 14 em. in diameter which on section shows a wall varying in thickness from 3 mm. to 3 em. and a cavity filled with a spongy degenerated material. Other fibroids scattered in the wall vary in diameter from 5 mm. to 6½ em., calcification being present in many places.

5708 HARPER AVENUE.

A NEW OBSTETRIC FORCEPS*

BY PROFESSOR E. H. ZWEIFEL, MUNICH, GERMANY

THE forceps was devised by Hugh Chamberlain about 1640, but as he concealed the invention of his instrument, we regard Pollyn of Ghent as the constructor of the forceps in 1723. Since that time there have been many improvements. During the past fifty years, two instruments have been constructed on new principles. The one is the Tarnier which is meant to be used as high forceps. Despite its distinct advantages, it compresses the fetal head in a most dangerous way. The Tarnier forceps causes not only an immediate high fetal mortality but also many permanent injuries to the brain of the child. The Kjelland forceps was constructed with the idea of always applying it biparietally. Kjelland especially recommended his forceps for parietal bone presentation and applies the anterior blade in such a manner that it is rotated within the uterus. This technic seems to be not without
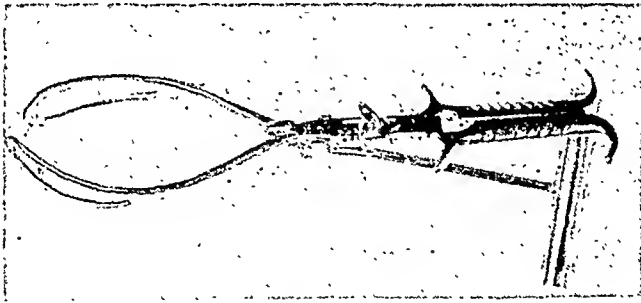
Fig. 1.

danger, as rupture of the uterus has been reported after the use of the Kjelland's forceps.

The construction of a new obstetric forceps was the outcome of a desire of mine to design a forceps which would combine in one instrument all the advantages of the modern models applied to the forecoming head.

The pelvic curve of this forceps is reduced to a minimum. The pelvic curve of obstetric forceps is practically superfluous with heads deep in the pelvis. When the head lies at a higher level, as for instance at the pelvic brim, it is a disadvantage. The same holds true for aftercoming heads.

For ordinary applications, this forceps is placed on the head just as the Naegele or the Simpson models. It can be applied in all diameters of the maternal pelvis and should always be applied biparietally to the child's head.

With high as well as with deep transverse heads, the new forceps can be brought to lie in the sagittal diameter of the pelvis, thus permitting a biparietal application. The particular advantage of the forceps lies in the fact that the

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*Presented (by invitation) before the Chicago Gynecological Society, May 29, 1930.

first blade can be introduced along the lateral wall of the pelvis and rotated into position, as in the usual "wandering" technic. Thus, it is not necessary, as with the Kjelland instrument, to introduce this blade under the symphysis, carry it high up into the uterus, and twist it through 180° at that level. The "wandering" method of application has always been possible and, therefore, we could apply the forceps biparietally. The blades slide, one upon another, but can be locked in various positions by a fixation screw. This is of the greatest value in high forceps applications upon heads lying asymmetrically as in asynclitism. For such cases, the forceps is supplied with a traction hook, providing for axis traction. At the upper end of this hook is a "catch" which permits application from below in a very simple manner. At the lower end is a revolvable transverse handle, for applying the traction. In high-lying heads, the hook is drawn upon in the direction of the pelvic axis, just as with the Tarnier forceps. The extraordinary ease with which the traction hook can be attached and detached is of special value. (Fig. 1.)

In many cases, traction alone is sufficient and the head rotates spontaneously as it is brought down. When traction does not bring about rotation, the latter can easily be encouraged with the forceps. Used in this manner, the forceps is as suitable for normal positions of the head, as for those associated with high arrests, transverse, face and brow presentations and so on. It has been applied in hundreds of cases up to the present time in the Universitäts Frauen Klinik in Munich and in Berlin, in the Kantonsspital in Aarau, in the Hebammenschule in Bamberg and in many other clinics and by many practitioners, with excellent results.

In addition, it has been used in some cases of impacted breech presentation in order to draw the child's breech to the pelvic outlet, then the forceps is taken off and the extraction is performed with the fingers in the usual way.

Rouffart: Sympathectomy in Gynecology. Bruxelles méd. 10: 232, 1929.

Rouffart, after a comprehensive discussion of the various aspects of sympathectomy in gynecology, draws the following conclusions:

We do not wish to advocate one method to the exclusion of other therapeutic measures. We wish only to show the value of this method despite the numerous unsettled points it possesses.

Hypogastric or preaortic sympathectomy is especially indicated in the treatment of pain in cancer cases. Resection of the superior hypogastric plexus is preferable in other cases. Both operations should be considered as sensory neurectomies. A sufficient resection of sympathetic connections causes a reduction of pain which proved unamenable in the other usual therapeutic measures, without affecting the harmony of the reflexes essential to vegetative life. These interventions have furthermore a hyperemic and trophic action capable of changing and cicatrizing hopeless lesions. But although they may be likened to sensory neurectomies, usually they are nothing more than complementary operations.

THEO. W. ADAMS.

Society Transactions

CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF MAY 29, 1930

DR. IRVING STEIN presented a case of **An Unusual Ovarian Tumor.**

This woman, thirty-four years old, had a placenta previa with her third pregnancy. The child was extracted after version and there was a tear of the cervix up to the fornix. The child died.

For about two years, there were no symptoms of significance. The third year she had a very severe metrorrhagia. She had some pain in the left lower quadrant, a marked leucorrhea and a daily temperature of 99.5°.
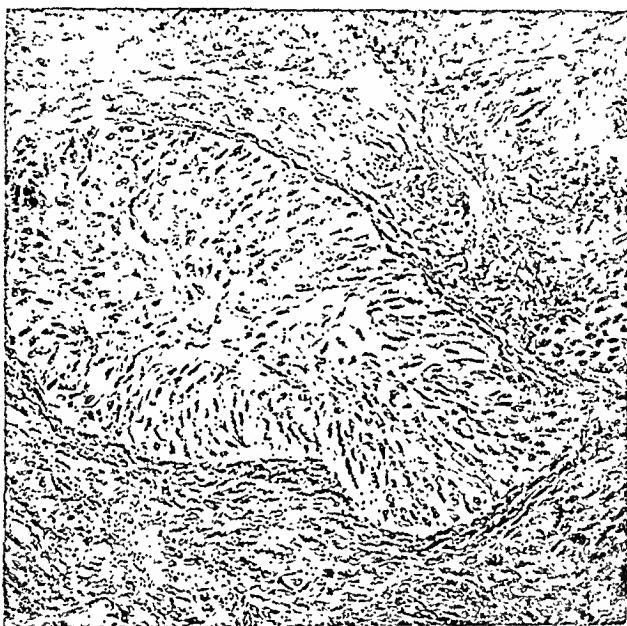
Fig. 1.

On admission, general examination was negative except for a chronic bronchitis. She had a tender ovarian swelling about 5 cm. in diameter apparently adherent to the apex of the cervical tear.

At operation a trachelorrhaphy and perineorrhaphy were first done. Then through a Pfannenstiel incision the peritoneal cavity was opened and an adherent, cystic ovarian tumor, 6 cm. in diameter was found. It was adherent in the culdesac just adjacent to the cervix, low down on the left side. The adhesions were broken up and the left tube and ovary and appendix were removed. The gross appearance at the time was that of a hemorrhagic corpus luteum cyst that was adherent in the pelvis. On microscopic examination, however, we found a rather peculiar looking area beneath this corpus luteum. In the middle of the ovary was a nodule a little less than a centimeter in diameter. A great number of sections were made, but a definite diagnosis was not established. Dr. Saphir's report is as follows:

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Sections of the ovarian tumor revealed a definitely circumscribed area, just below a corpus luteum cyst, made up of clusters of epithelial cells. These groups or clusters varied in size, some large enough to cover the entire field. They were chiefly round, some oval and the individual cells were uniform in size and shape. (Fig. 1.) The cytoplasm stained lightly, nuclei centrally placed and vascular, and an occasional mitotic figure was seen. There was a resemblance of some of these cells to the carcinoma cells. There was a suggestion of alveolar arrangement with a moderate amount of stroma surrounding the clusters. In some sections were seen small circumscribed spaces stained pink, but no definite ova were recognizable in them. No definite invasion of the stroma was seen by the epithelial cells. There was also no evidence of gland formation. The remainder of the ovary contained a few cysts and one large corpus luteum with extensive hemorrhages within it. There was a slight increase in connective tissue in the ovarian stroma. In one part of the section, a few tubuli were recognizable which resembled remnants of wolffian duct structures.

Our first reaction was that it was probably a dermoid cyst, but there was no tissue to which that could be definitely identified, such as skin, hair, bone, muscle or cartilage, such as is found in dermoid.

Dr. Robert T. Frank and Dr. Klemperer diagnosed it as a wolffian duct inclusion.

DR. LOUIS RUDOLPH AND DR. A. C. IVY presented a paper entitled, **The Coordination of the Uterus in Labor.** (For original article see page 65.)

DISCUSSION

DR. IRVING F. STEIN.—In regard to the asynchronous contraction of the tubes in the cornua of the uterus, we have verified that with lipiodol in the human subject. Frequently, after the injection of lipiodol, the first manifestation was a closure of the tube ends. That we call a cornual spasm. The spasm begins in the cornua of the uterus rather than in the isthmus of the tube. Then we have seen one side open before the other. One may fill entirely before the other, or one may fill and the other remain empty. Some of those cases at laparotomy have been found to have patent tubes. I think that is what Dr. Ivy and Dr. Rudolph have shown, that there is asynchronous contraction of the tube. The contractions begin at the cornua of the uterus and are not always simultaneous.

DR. FREDERICK FALLS.—This work calls attention to the fact that the human uterus is fundamentally a bicornate uterus. If we watch for clinical evidence of bicornuosity in the human uterus, it will be found much more frequently than textbooks in obstetrics suggest. Several observations in the last few years have lead us to watch for this anomaly particularly. In these cases the uterus is found to be deflected either to the right or the left side of the body. When three-fourths of the uterus is to the right or the left, frequently labor will be found to give trouble. The contractions of the uterus are not normal in strength or frequency. The length of labor is usually prolonged but in some instances may be very much shortened. In addition to that, the baby may die during labor. In certain cases, the heart tones will be very rapid even before labor starts. In one case heart tones of 160 to 180 were observed before labor started. This baby died in the first stage with only 2 to 3 cm. dilatation, so it is not probable that there was any compression of the head. We have assumed that this is in some way due to defect in the circulation of blood in the placenta.

We should pay more attention to irregular uterine contractions and irregularly shaped uteri, and realize that the human uterus is frequently bicornate and that these uteri give rise to complicated labors.

It is very difficult to measure the strength of uterine contractions. Some years ago we tried to measure this by using a galvanometer to measure the action current that was generated by the contraction of the uterine muscle. We were successful in that.

DR. CARL HENRY DAVIS.—Some years ago one of the most prominent members of the American Gynecological Society confessed that he had done a cesarean section because of the presence of a fibroid, and at term failed to find any evidence of the fibroid. About that same time a patient was seen by Dr. Barrett and myself at different times, in whom another physician had made a diagnosis of fibroid and insisted that she be delivered by section. Neither of us could find the fibroid. The physiologic study reported gives us an explanation for these irregular contractions of the uterus which we sometimes find in early pregnancy and early labor.

DR. A. C. IVY.—It is well known that if you simply take out a strip of the uterus and put it in Locke's solution, it will contract rhythmically, just like a strip of intestinal muscle. Now, a possibility to which we did not refer is that it may be that this coordinated rhythm which we have shown to exist between the corpus uteri and the horn may be a fundamental property of the various portions of the musculature of the uterus. One has to stretch his imagination quite far, however, to imagine how one transverse section of the uterus will be timed with the remaining transverse portions. It is much more simple to think of some special coordinating mechanism, such as has been demonstrated by our experiments. The continuation of contractions by a uterine strip is analogous to those manifested by a strip of the stomach; but the contractions of a gastric strip are not analogous to normal gastric peristalsis.

In answer to Dr. Jones, we have cut both pelvic and hypogastric nerves and have removed the hypogastric ganglion.

DR. RUDOLPH (closing).—Our paper had to be abstracted so that we left out certain phases that related to the condition described by Dr. Davis.

In view of our theory of the bilateral origin of the uterus and its bilateral coordinating mechanism, it appears probable that unilateral relaxation of one side of the uterus and a normal tonus of the opposite occurs during pregnancy and labor, which we believe is the explanation of lateral obliquity of the uterus.

In a case that we report, a cyst-like protrusion occurred at the upper left quadrant of the uterus during the uterine contractions, and was associated with a left lateral obliquity of the uterus. In the interval, the uterus was symmetrical. After the bag of waters ruptured the uterus became symmetrical during the subsequent labor pains and labor progressed in a normal manner. We believe that this condition is due to a change of tonus of the two halves of the uterus; the right half contracting in a normal manner, while the left half of the uterus was in a state of paresis and a paralysis of the corresponding orbicular muscles of Ruysch which accounts for the cyst that appeared and the left lateral obliquity of the uterus during the labor pains before the bag of waters ruptured.

DR. ZWEIFEL presented **A New Obstetric Forceps**, see page 138.

Department of Maternal Welfare

CONDUCTED BY FRED L. ADAIR, M.D., CHICAGO, ILL.

A SURVEY OF MATERNAL DEATHS IN MARYLAND*

By J. H. MASON KNOX, PH.D., M.D., BALTIMORE, MARYLAND

(Chief of the Bureau of Child Hygiene, State Dept. of Health)

A SURVEY of the maternal deaths occurring in the counties of Maryland, exclusive of the city of Baltimore, during the last three years, 1927, 1928, and 1929, has just been completed.

In addition to Baltimore there are but four cities in the State having a population in excess of 10,000. The study, therefore, comprises principally information concerning the women who died in childbearing in the rural and small town areas.

The information on which the survey was made was obtained through personal interviews, by two experienced women physicians, with the practitioners concerned, for the 1927 and 1928 cases and by the same method by local health officers in 1929.

Maryland has a lower maternal mortality rate than many of her sister states. The rate for the Birth Registration Area in 1927, the latest published, was 6.5 as compared to 4.95 in Maryland.

It is thought, therefore, that the results of this study in rural Maryland may be of general interest and may fairly represent conditions prevailing in many other states.

The fatal cases investigated were 241 in number, occurring in 47,515 live births, giving a maternal mortality rate in rural Maryland of 5.06 per 1,000 live births.

Cause of Death.—The primary causes of death in the 241 cases reviewed were:

Accidents of pregnancy, abortion, ectopic gestation (143)*	27	11.0%
Puerperal hemorrhage (144)	36	14.9%
Other accidents of labor including cesarean section, difficult labor, ruptured uterus (145)	19	7.8%
Puerperal septicemia (146)	82	34.0%
Puerperal phlegmasia alba dolens embolus, sudden death (147)	10	4.0%
Puerperal albuminuria and convulsions (148)	67	27.8%
	241	99.5%

*Refer to International list of causes of death.

It is to be noted that puerperal sepsis and albuminuria and convulsions together caused the death of 149 women, or 61.8 per cent of the whole number.

Sixty-five of these deaths, or 27 per cent of the 241 cases, occurred in association with an interruption of the pregnancy before the seventh month; that is, with abortion or premature birth.

The primary cause in this group is indicated below:

Accidents of pregnancy, abortion, ectopic gestation (143)	21	32.4%
Puerperal hemorrhage (144)	3	4.6%
Other accidents of labor including cesarean section, difficult labor, ruptured uterus (145)	0	
Puerperal septicemia (146)	33	50.7%
Puerperal phlegmasia alba dolens embolus, sudden death (147)	0	
Puerperal albuminuria and convulsions (148)	8	12.3%
	65	100 %

In these instances of a prematurely interrupted gestation the incidence of sepsis is extremely high; 50 per cent.

These figures would indicate that in general the dangers to the mother from the most feared complication of pregnancy are materially increased when the gestation is interrupted before term and that such a procedure should be undertaken only under the direction of skilled medical advice.

Attendant at Birth.—The attendant at birth is shown in the accompanying table together with the primary cause of death, in cases of seven months or more gestation:

TABLE I

	TOTAL	ACCIDENTS OF PREGNANCY	HEMORRHAGE	OTHER ACCIDENTS OF PREGNANCY	SEPTICEMIA	ALBA DOLENS	ALBUMINURIA	OTHERS
Maternal deaths	176	6	33	19	49	8	59	2
Attended by phys. alone	145	6	26	18	38	7	49	1
Physician after midwife or other attendant	14	0	3	0	6	1	3	1
Midwife alone	8	0	2	0	4	0	2	0
Other attendant or none	9	0	2	1	1	0	5	0

Only those cases which died after seven months gestation are included—176 in number. For this group there should have been ample time to make arrangement for the prenatal care of the mother and for the conduction of labor.

Special effort was made to ascertain those cases in which a midwife or other attendant preceded the doctor in the care of the patient.

The surveys show that a large proportion of these 176 women, 145 or 82 per cent, were attended by physicians alone, and that in 14, or 8 per cent of the cases, the physician was called after a midwife or other attendant had been in charge, while in 17 instances or 10 per cent the patients were delivered by midwives alone or were delivered with no attendant.

It is to be noted that among the women whose pregnancy lasted more than seven months, 108 or 61 per cent of the deaths were due to septicemia and albuminuria.

Race.—In 241 deaths in the counties of Maryland, 164 occurred among white women and 77 among colored women, the maternal mortality per thousand live births for these groups being 4.1 for white and 8 for colored.

Age.—Analysis of our cases according to age indicates that 94 of these deaths occurred among women between twenty and thirty years of age, and 78 between thirty and forty, that is 71 per cent were between twenty and forty years of age. There were 172 deaths in women in their early prime when they should have had a long life expectancy.

Social Status.—Among our 241 cases, 215 or 89 per cent were married, 26 or 11 per cent were not married. Of the 164 white women, 158 or 96 per cent were married; 6 or 4 per cent were unmarried, and of the 77 colored women, 57 or 74 per cent were married and 20 or 26 per cent unmarried.

Previous Children.—One hundred fifty-nine or 66 per cent of the deaths occurred among women who were mothers of older children who were left in the home bereft of the mother's care. These facts seem tragic enough to arrest attention and should lead to some concerted professional or community action to reduce the unnecessary deaths among women so greatly needed.

Prenatal Care.—Inquiry was made in each case as to the kind of examination and medical attention the patient received before delivery. When this comprised a general examination including that of the heart, lungs, abdomen, measurement of the pelvis in primipara, examination of urine and determination of blood pressure not later than in the seventh month of pregnancy, such prenatal care was designated as ''good.'' Some attention to the patient less than above summarized was called ''inadequate'' prenatal care.

Of 176 women who died after seven months or more gestation, 15 or 8 per cent received good prenatal care, 63 or 35 per cent received inadequate prenatal care, and 98 or 56 per cent received no prenatal care. In the series of 176 women who died after pregnancy of seven months, measurement of the pelvis was reported in but 18 instances and the Wassermann test was made in only 5 cases. The value of prenatal care in reducing maternal and neonatal mortality and in lessening the number of stillbirths is so well understood that no additional proof or argument in its favor is necessary.

Dr. Dublin, statistician of the Metropolitan Life Insurance Company, estimates that the lives of two out of every three American women who die each year during pregnancy, in childbirth, or shortly thereafter, could be saved if they received medical and nursing care. This means that at least 10,000 of the 15,000 deaths among women from some complication of childbirth in the United States are preventable.

Hospital Deaths.—In our series of 241 fatal cases death occurred at home in 108 instances or 44 per cent and in a hospital in 133 instances or 55 per cent. It should be stated, however, that in nearly every one of these hospital deaths the patient's symptoms began at home and she was brought to the hospital in a critical condition and that the aid of the hospital was sought because of urgent symptoms of which the attending physician had learned for the first time immediately before bringing the patient to the hospital.

SUMMARY

It must be evident from these figures which have been briefly summarized that a considerable number of women in the last three years lost their lives in the counties of Maryland without satisfactory care before or during childbirth.

These women are for the most part not the very young or the old in years, but in the majority of instances the lives that were lost were those of married women living in normal homes and frequently mothers of older children. In other words, they comprise a group that cannot be lost without great loss in many ways to their families and to the communities in which they lived.

A surprisingly large percentage of the deaths resulted from premature births among women who had not been under medical advice.

Careless and ignorant midwives were associated with these maternal deaths in only a small proportion of these cases.

The impression we have received from this review of maternal deaths in the counties of Maryland is that they were due directly or indirectly to the ignorance

or indifference of the people themselves. Help from physician or midwife was rarely called for until alarming and dangerous complications had arisen and the physician was obliged to take emergency measures under unfavorable conditions. The patients who were reported to have died in hospitals were almost without exception admitted extremely ill when there was but little that could be done to save them.

The apparent acceptance on the part of families and the public of the many deaths in childbearing as a matter which cannot be changed, deserves serious consideration. For until this attitude is altered and it is recognized generally that when a woman is in competent hands early in her pregnancy the dangers of childbearing are greatly lessened, we shall continue to lose many lives unnecessarily.

Certainly it is most desirable that those undertaking obstetric work should have adequate training and experience. This matter is receiving attention by many medical faculties.

However, a review of the maternal deaths here presented shows that but few of them could have been saved by more skilled hands at the critical period in which the physician was first called. Already sepsis or toxemia or other complication was so far developed as to render the best treatment unavailing.

We were not able to determine in our series how much of the delay in calling in a doctor was due to the desire to save money. This seems to have been a factor in a considerable number of instances. Certainly the usual fee in the counties for obstetric service is a moderate return for the value of this service. Moreover, it is a charge which can be anticipated and saved for; as is not true of sudden or unexpected illness. We are told, however, that the cost of illness cannot be defrayed out of the available income in the case of about one-third of the American homes and presumably this is true also of the cost of bearing children. When the dangers of procrastination *are not understood,* the doctor's services are dispensed with as long as possible.

Obstetric service is provided free of all charge by private practitioners in many instances, greatly to the credit of the physician; but this is not fair to either doctor or patient who may not want to be a receiver of charity.

In the rural sections there is no obstetric service available to the indigent such as is offered to the corresponding group in Baltimore through the Johns Hopkins Hospital and the Hospital of the University of Maryland and other clinics. Hospital beds, free or at moderate cost, are provided in the county hospitals. There is still much unwillingness to make use of them for normal cases. If there were a general demand for such accommodation, the beds would prove far too few.

It would seem then that there is need in each county for some organized plan by which obstetric service could be furnished at little or no cost to those families of very moderate means. From such families come most of our maternal deaths at present.

It is hardly reasonable to expect a physician whose practice covers a large area to undertake gratis the care of widely separated normal obstetric cases. If the private physician is to continue to do this charity work, he should receive from the county or elsewhere an adequate financial return.

It is the custom of a number of doctors in the counties to use midwives whom they know to be capable and clean in their obstetric practice among the poor.

The midwife in Europe, as is well known, occupies a more important position than with us. There she delivers nearly all normal cases and calls upon the physician only when difficulties arise.

Our midwives in Maryland are far below those in Europe in education and training. However, the older ones are dying out and the newer ones have had some instruction and have passed a qualifying examination. The standard among them

would be greatly raised if a carefully selected number could be received in some of our county hospitals and given instruction and practical experience. This could be arranged with but little expense to the hospital.

It is conceivable that a physician with an active obstetric practice might make use of three or four midwives resident in different communities covered by his practice for delivering normal cases under his supervision. It would be advisable that he make at least one complete physical examination and be ready to respond if unforeseen difficulties appeared.

There are now public health nurses in every county who are willing to visit any indigent expectant mothers at the request of a physician, give them such prenatal instruction as the physician desires and report to him at regular intervals. In two counties prenatal clinics have been organized with the approval of the profession for the examination and advice of indigent expectant women.

We have received monthly reports from one of those prenatal clinics. The patients are either referred by local physicians or are indigent women, found by the public health nurses, who had made no arrangement for their care before or during labor.

Of some 50 of these cases at least 10 were suffering from conditions which probably would have resulted fatally except for the care received at the clinic. Thus far there have been no maternal deaths.

Would it not be possible in each county for the physicians themselves, or if they desire it, with the assistance of an experienced obstetrician, to organize a similar clinic where indigent expectant mothers may be examined early in their pregnancy, receive prenatal advice, and be helped to make suitable arrangements for their labor? To such a clinic the local physician might care to refer certain of his own patients and examine them himself. Probably many midwives could be encouraged to send their patients to such a clinic for examination and prenatal advice. A regular prenatal clinic in a county could readily be made a useful teaching center for physicians and so of mutual advantage both to the patient and to the profession.

It has been suggested that a wider use in the counties of maternity insurance would bring improvement to the conditions it is so desirable to remedy. It is to be feared, however, that the group it seems especially necessary to help, would not be willing, perhaps not able, to pay the necessary premiums. It is quite evident that the profession cannot be, and the public ought not to be, satisfied with the present state of affairs.

Through some plan, such as the more frequent use of the county hospital, the use and supervision of selected midwives, the prenatal clinic, maternity insurance, or the employment of the public health nurses, the physician might be able to supply at less sacrifice of his own valuable time and at less financial cost to his patient of moderate means, satisfactory prenatal and natal care, both of which seem desirable from the study of the maternal deaths.

The fundamental part of any plan, however, for better service, is the necessity of bringing home to each prospective father and mother in the State, and to every community, that not to attempt to furnish every expectant mother with at least a minimum of medical care during her waiting period and at the hour of labor, is little short of criminal negligence.

It is recognized that excellent and early care of the expectant mother and skilled obstetric service will not save all women in childbearing, but it is confidently believed it would result each year in the salvage of one-third of the lives of mothers, and one-third of the potential infant lives now being lost before or shortly after birth. This is certainly a goal worth striving for.

Editorial Comments

Certification of Specialists

ATTENTION has already been called in our pages to the organization of the American Board of Obstetrics and Gynecology, created for the purpose of determining the competency of specialists in obstetrics and gynecology. The capabilities and proper designation of a specialist are matters which concern the public as well as the medical profession. With the enormous growth in medicine during recent years, it is obviously impossible for any one individual to familiarize himself with all the diagnostic refinements and therapeutic methods utilized in its various branches; hence, a demand for specially qualified practitioners is the logical sequence of such a state of affairs. Naturally difficulties have arisen in distinguishing between those who have been thoroughly trained, and those who have not. Thus far, so-called specialism has been practically uncontrolled. Sufficient contact with the general practice of medicine, so essential as a balance wheel for the potential specialist, has been largely disregarded. Internes graduated from one or another hospital service are all too ready to restrict their practice within the confines of some special field of medicine, or men in general practice go to a postgraduate school for a course which is all too brief, or perhaps spend a year abroad, and then pose as qualified specialists despite the inadequacy of their preparation.

The State makes no effort to standardize qualifications for the specialist: it grants a license which empowers its holder to practice any or all branches of medicine, and after that leaves the matter of his professional activities entirely to chance. Fortunately, many men have seriously fitted themselves for specialism by long service in an accredited hospital and under the supervision of competent teachers, as well as by wide clinical experience and intensive study and reading. But there have been few or no standards established whereby the pub-

lic at large can determine the individual's proficiency, except those set up by certain bodies whose membership represents national medical societies and who have seen the need for action. The task of fixing even minimum requirements for the average practicing specialist is a difficult one, and every credit should be given to those groups who are attempting to solve what only a short time ago seemed like an impossible problem. The ophthalmologists, the otologists, and the laryngologists have constituted themselves a vanguard with which the obstetricians and gynecologists have now joined ranks, in an effort to do for American medicine what no governmental agency can well undertake. Such reforms emanating from within the ranks of the profession itself will undoubtedly contribute more largely to public confidence than would any legislative action.

The American Board of Obstetrics and Gynecology was launched last September and is now actively functioning. It is composed of three representatives from each of the three national groups interested in obstetrics and gynecology: the American Association of Obstetricians, Gynecologists and Abdominal Surgeons; the American Gynecological Society; and the Section on Obstetrics and Gynecology of the American Medical Association. The members of the Board are to be congratulated on the rapidity with which they have formulated their plans and regulations, and have begun the actual work of certifying specialists by examination and otherwise. During the early period of the Board's career trivial errors may be made, and perhaps certain details may meet with criticism, but its objectives are so meritorious and worthy of support by the profession that patience in the adjustment of details must be exercised until the project is well stabilized. Proper recognition of its undoubted value by the lay public and medical profession alike is inevitable.

Intensive Prenatal Care

WITH the growth of medicine and the recognition of the fact that good health is a matter of public as well as of individual interest, there have been developed many now widespread social welfare activities by lay and governmental agencies. Tuberculosis, heart disease, the infectious diseases of childhood, cancer and, naturally, because of its sympathetic appeal, childbearing, have all served as nuclei for specific organizations which have been most helpful and important in the solution of many medical problems. To these organizations there must be given much credit for the success attained in lowering the incidence and mortality of many of the more widespread illnesses, and this applies likewise to the complex problems associated with any hoped for improvement in the mortality and morbidity associated with childbearing. Perhaps the most extensive and noteworthy movement of the kind in this country has been the attempt by the federal government to

develop a nation-wide interest in this field through the medium of the Shepard-Towner Act, and more recently the White House Conference. The former failed for lack of continued appropriations by Congress. It was never convincingly successful because the measure violated certain structural relations in our government and for other reasons that need not be discussed here, but the propaganda associated with the same did arouse the national conscience.

The recent White House Conference has served to continue this interest and it is unfortunate that the occasion should have been made use of to launch a propaganda for a separate Children's Bureau rather than to have this activity as part of a policy of unified health control. True the child is an entity but he and his problems are closely related to his environment and in the latter his mother plays an important part. Therefore the preservation of her maternal functions must likewise be regarded as an essential link in the chain of obstetric supervision, which includes watchful care over all of the stages of pregnancy rather than the imposition of any one inclusive remedy. The good results of such supervision have been most satisfactorily demonstrated by the work of certain well-organized groups, of which the Maternity Center Association of New York forms a conspicuous example. A detailed report of the activities of this Association was published in the December issue of the JOURNAL, and shows in very dramatic fashion that intensive prenatal care associated with correspondingly satisfactory attendance during labor will produce results that are worthy not only of commendation but should serve as a stimulus for emulation in other places.

Such community developments, with local responsibility and interest as guiding factors, will do more than any centralized governmental agency to bring about that needed consciousness among our people for the best possible obstetric care obtainable. When it can be demonstrated that in a group of 5000 mothers cared for by this Association during an eight-year period, the mortality was about one-third of that in the same area among other women, with a reduction in stillbirths of over 40 per cent and of infant deaths of over 30 per cent as compared with the control groups, there should be no question of the value of such services. And these results have very definite implications for they show the need of similar machinery elsewhere. In this connection attention may be called to an estimate made by Dr. Louis I. Dublin, the well-known statistician, that the lives of two out of every three American women who die each year as the result of childbearing could be saved if they received satisfactory medical and nursing care, which means that two-thirds of these deaths are preventable. This is a challenge that the medical profession should not be slow to accept.

Department of Reviews and Abstracts

Selected Abstracts

Fetal Injuries

Freund and Schmitt: The Influence of Ultraviolet Irradiation of the Mother on the Constitution of the Newborn. Monatschr. f. Kinderh. 43: 424, 1929.

The authors employed the quartz lamp in increasing doses from two to twenty minutes on a series of pregnant women, using every other patient admitted to the clinic as control. The irradiation was continued throughout the period of pregnancy and varied from one-half to twelve hours in toto according to when the patient presented herself. The children subsequently born were studied as to differences in length, in weight, relationship of head circumference to chest circumference, the development of rickets as shown by x-ray and clinically, and differences in blood phosphates. The results were as follows: Those who received irradiation showed an average increase in length of 0.6 cm. Of these, children born during the winter months, October to April, showed an increase of 1.3 cm. while those born during the summer months, April to October, showed only a 0.09 cm. increase. In weight the average difference was 97 grams, with a corresponding increase to 213 grams during the winter months for those irradiated. The relationship between head and chest circumference in both groups did not vary sufficiently to warrant conclusions, and the cases studied as to onset of rickets were too few. Of 13 irradiated cases studied for blood phosphates 7 were above normal, 4 normal, and 2 below normal. Of 8 cases not treated, 2 were above normal, 3 normal, and 3 below normal.

The authors believe that although their study has been of short duration and in relatively few cases, there is a distinct superiority shown in children whose mothers have been irradiated antepartum, especially in those children born during the winter months.

FRANK SPIELMAN.

Unterberger: Damage to the Fetus through Repeated Exposures to Roentgen Ray During Pregnancy. Zentralbl. f. Gynäk. 53: 44, 1929.

The article is based on a single case, a woman aged forty-three, who had been under the writer's care for years. She had had infantile genitalia when first seen. At thirty-nine she was a primipara, at which time she had a gastroenterostomy done during the third month of pregnancy for a bleeding peptic ulcer. This pregnancy and the succeeding one resulted in normal offspring. About the third or fourth month of the third pregnancy, the patient again had marked gastric symptoms, and had a series of x-rays after an opaque meal for diagnostic purposes. Gastric carcinoma was suspected, but at laparotomy it was found that the defects observed in the plates were caused by numerous dense adhesions. These were freed, and post-operatively another series of x-rays was taken. Soon a low grade hydramnios developed. The patient delivered about 4 weeks prematurely a small fetus which

lived only five minutes, after an unusually long labor which was terminated by forceps. Postmortem examination of the fetus showed an anasarca and general evidences of underdevelopment in all the thoracic and abdominal viscera. The blood showed a distinctly fetal type of cells. Neither the child nor the parents had any evidences of syphilis or nephritis. The author concludes from this that the condition of the fetus was due to the repeated exposure to the roentgen ray, and he is sustained in this view by Prof. Kaiserling, who did the autopsy on the fetus. Therefore, the author emphasizes that special care should be used in similar cases.

<div align="right">WILLIAM F. MENGERT.</div>

Doederlein: Radiotherapy and Progenity. Deutsche med. Wchnschr. 54: 1997, 1928.

The author reports 11 cases of conception and delivery of healthy children after a varying period of amenorrhea produced by radiation (x-ray and radium).

''Should this experience of the birth of healthy children after late conception following radiotherapy be generally confirmed, then the objection against temporary sterilization would be overcome and great possibilities for a new therapeutic procedure become evident.''

<div align="right">GRUENFELD.</div>

Fischer: Radiotherapy and Progenity. Deutsche med. Wchnschr. 55: 89, 1929.

The author warns the profession, on the basis of theoretic consideration and experimental experience, to regard radiation as nondetrimental to the offspring, because the first generation has not shown anomalies.

Damage to the germ may show in later generations or may become evident when two individuals with non-evident radiation-damage to their generative cells should procreate children. This theoretic criticism is the application of the Mendelian laws to the problem whether and when a damage to the ovum by radiation will become evident.

Experiments on mammals have not yet been carried out in a conclusive way to prove or disprove that radiation is innocuous to the progenity.

<div align="right">GRUENFELD.</div>

Peig, J. C.: Diversity of Invasion by the Treponema in a Case of Twins. Revista espan. de obst. y ginec. 14: 152, 1929.

A secundipara with strongly positive Wassermann reaction had a premature infant in her first pregnancy which died of meningitis when 8 months old. Her second pregnancy was complicated by hydramnios and terminated in the birth of twins. The first fetus weighing 1600 grams was dead and macerated. The second weighing 1300 grams was born alive but survived only thirty hours. There were two placentas and two distinct sacs. The macerated fetus showed the luetic stigmas to a marked degree, and examination of its liver pulp revealed spirochetes. The other showed only slight evidence of the condition, and liver pulp examination was entirely negative. The placenta of the first was discolored and edematous, the second apparently normal.

The author explains the difference in intensity of the reaction in the fetuses partially on the basis of a greater resistance of the placental filter in one of them. The main reason lies in the different physicochemical composition of the twins, each of which, since they arose from different ova, must be regarded as being a distinct individual capable of a different response to the infection.

<div align="right">FRANK SPIELMAN.</div>

Klaften, E.: The Treatment of Newborn Infants of Syphilitic Mothers, Arch. f. Gynäk. 134: 88, 1928.

There is a tremendous mortality from syphilis during the first three months of life which can be materially reduced by means of systematic treatment both during pregnancy and in the first weeks of extrauterine life. Of the children born of mothers who had active secondary syphilis during their pregnancy 90 per cent can be kept alive by active and intensive antiluetic treatment and 75 per cent of such children will, if properly treated, never show any evidences or symptoms of syphilis. Even if the syphilitic infection in the mother be a latent one, the child should immediately be subjected to active antisyphilitic treatment with arsphenamine, bismuth, etc. Klaften treated 48 apparently healthy children of mothers suffering from latent syphilis and of these only two died. Three others developed syphilis in spite of the treatment and 43 remained healthy and exhibited negative serum reactions. Of 84 children of mothers with latent syphilis who were not given antiluetic treatment, only 46 were alive and free from syphilis after three months.

The newborn infants tolerate comparatively large doses of arsphenamine very well. Those infants who do not react well show evidences of luetic changes in the organs in spite of the treatment and due to the spirochetal invasion.

RALPH A. REIS.

Arbat: New Methods in the Treatment of Hereditary Lues. The Activation of the Specific Therapy by Transfusion. Revista espan. de obst. y ginec. 14: 155, 1929.

The results obtained in the newborn with antiluetic treatment are not nearly as good as those obtained in the adult. The reason for this is to be found in the inability of the newborn organism to respond to specific treatment. The therapeutic coefficient of the various preparations of mercury, arsenic, and bismuth depends on the activation of the drugs, a factor determined by the organism. As proof of this there is the fact that different effects are obtained with the same preparations in different patients. Also, the effects of cutaneous proteid injections vary.

In the hope of producing a better response to therapy the author combines whole blood with the preparation used and injects the mixture. The advantages to be derived from this method are activation of the product by the ferments of the blood, and an increase in the natural defensive power of the organism by the transfusion. The injections are made into the muscle every three days after the first, and every four days after the seventh injection. Sulfarsenol in increasing doses from ⅛ centigram to 2 centigrams per kilo body weight is mixed with mother's blood in quantities varying from ½ to 1 c.c. The anticoagulant property of the arsenicals is an aid in using this method.

The only untoward effects observed in a considerable number of cases have been transient icterus and slight temperature. The results have warranted its continued use.

FRANK SPIELMAN.

Gammeltoft, S. A.: A Case of Encephalitis Hemorrhagica After Salvarsan Treatment During Pregnancy. Acta obst. et gynec. Scandinav. 9: 167, 1930.

The author reports a case of hemorrhagic encephalitis which followed the administration of salvarsan to a pregnant woman and he compares this case with three similar cases observed in Denmark. He emphasizes that even though this danger is slight, the treatment of syphilis during pregnancy should be supervised by specialists because they alone can detect the early signs of harm done by salvarsan.

J. P. GREENHILL.

Correspondence

Extension Courses

To the Editor.—There is much to commend in the plans of "extension teaching in obstetrics" recently suggested by Dr. James R. McCord (this Journal, November, 1930) and Dr. E. D. Plass (*J. Iowa State Med. Society,* April, 1930). It is very evident that these teachers appreciate their great responsibility. However, it is equally apparent that their efforts do not entirely meet the requirements. There is no short cut to knowledge, and least of all, in obstetrics. Either a man "knows his stuff" or he does not know it. Either he is, or he is not, an obstetrician.

The art and skill required to qualify in this capacity are not learned in a few hours. We regard as misleading and pernicious the absurd implication that several standards of obstetric practice must necessarily prevail in this country. To receive every aid that modern medicine affords is the "divine right" of every "woman with the badge of maternity upon her." The fact that nineteen out of every twenty women would deliver themselves without or in spite of any artificial aid, only tends to obscure the principle involved.

Moreover "our statistics" will not improve until it is frankly acknowledged and frequently emphasized by "leaders of the profession" that the art of obstetrics including gynecology, is an interesting, comprehensive, and an exacting specialty worthy of any man's entire time, talent, and skill.

Extension teaching should include, moreover, at least one short intensive demonstration in general practice. Recent graduates are habitually urged to locate in remote rural districts. In this situation they are enjoined to practice medicine and surgery. There is no doubt that it would be instructive to observe just how a "professor" would react when asked to deliver modern medicine, in all its manifold clinical and technical complexities, at the bedside of patients. If tragi-comic incidents could be avoided such a course would be extremely helpful and popular.

NICHOLAS SCHILLING, M.D.

NEW HAMPTON, IOWA.

Item

Announcement of Examinations by the American Board of Obstetrics and Gynecology

The following announcement has been received from the Secretary of this Board:

"The written examination must be taken by all applicants classified in Group 3 (see booklet), and will be held on Saturday, March 14, 1931, at 2 P.M. in the following cities:

New York City	Boston, Mass.
Chicago	Grand Rapids, Mich.
Philadelphia	Baltimore, Md.
Toronto, Ontario	Atlanta, Georgia
Indianapolis, Ind.	Cincinnati, Ohio
Portland, Oregon	San Francisco, Cal.
Rochester, Minn.	Grand Forks, North Dakota
Iowa City, Iowa	Denver, Colorado
St. Louis, Mo.	Galveston, Texas

Raleigh, North Carolina

"This examination will consist of ten questions pertaining to obstetrics and gynecology, and a rating of 75 per cent will be required. Each candidate for Group 3 also will be required to submit typewritten reports on a total of fifty (50) obstetrical and gynecological operations which he has performed, and these case records are to be presented with his examination paper to his local examiner on March 14.

"The practical, or oral, clinical and laboratory examination will be held in Philadelphia, Pa., on Saturday, June 6, 1931, commencing at 9 A.M. and will be given to all applicants in Group 2 and Group 3. The candidates will be expected to identify and discuss three or four common obstetrical and gynecological pathologic specimens and the histologic sections taken from them. The clinical part of the examination will be conducted in a hospital where an individual case will be discussed in detail with each candidate. An endeavor will be made to adapt the details of the oral examination to each candidate's previous experience and practice, and will be particularly directed to ascertain his familiarity with recent obstetrical and gynecological literature, the breadth of his clinical experience, and his general qualifications as a specialist in obstetrics and gynecology.

"Each candidate in Group 3 will be expected to appear before the examiner or assistant examiner in the territorial district in which the candidate resides, unless special arrangements otherwise have been made in advance through the Secretary, for the written examination on March 14. He should notify the Secretary before February 21 as to which of the two cities of his district he will present himself for examination, so that his credentials may be forwarded to the proper examiner in advance. The territorial districts, the examiner's names, and the places of examination appear below.

"In each instance the examination papers and case records will be sent to be reviewed and marked by an examiner in another district from that in which the candidate resides and tries his examination.

TERRITORIAL DISTRICTS

1. New York; Maine; New Hampshire; Vermont; Massachusetts; Rhode Island; Connecticut.
   Examiner: Dr. Walter T. Dannreuther, New York City.
   Ass't Examiner: Dr. Louis Phaneuf, Boston.
2. Illinois; Michigan; Wisconsin.
   Examiner: Dr. Fred L. Adair, Chicago.
   Ass't Examiner: Dr. Alex. Campbell, Grand Rapids, Mich.
3. Pennsylvania; New Jersey; Delaware; Maryland; Virginia; West Virginia; District of Columbia.
   Examiner: Dr. Edward A. Schumann, Philadelphia.
   Ass't Examiner: Dr. Edward B. Richardson, Baltimore.
4. North Carolina; South Carolina; Georgia; Florida; Alabama; Louisiana; Mississippi.
   Examiner: Dr. Paul Titus, Pittsburgh, Pa.
   Ass't Examiner: Dr. J. R. McCord, Atlanta, Georgia.
     Raleigh, North Carolina (subject to possible change to Atlanta).
5. Ohio; Indiana; Tennessee; Kentucky.
   Examiner: Dr. Joseph L. Baer, Chicago, Ill.
   Ass't Examiner: Dr. Magnus A. Tate, Cincinnati, Ohio.
     Indianapolis, Ind. (subject to possible change to Cincinnati).
6. Washington; Oregon; California; Nevada.
   Examiner: Dr. Jennings Litzenberg of Minneapolis, Minn.
   Ass't Examiner: Dr. Frank W. Lynch, San Francisco, Cal.
     Portland, Oregon (subject to possible change to San Francisco).

7. Minnesota; North Dakota; South Dakota; Idaho; Montana; Wyoming.
      Examiner: Dr. R. D. Mussey, Rochester, Minn.
      Ass't Examiner: Dr. J. H. Moore, Grand Forks, North Dakota.
8. Iowa; Nebraska; Colorado; Utah.
      Examiner: Dr. E. D. Plass, Iowa City, Iowa.
      Ass't Examiner: Dr. C. B. Ingraham, Denver, Colo.
9. Missouri; Kansas; Nebraska; Arkansas; Texas; Arizona; Oklahoma; New Mexico.
      Examiner: Dr. G. D. Royston, St. Louis, Mo.
      Ass't Examiner: Dr. W. R. Cooke, Galveston, Texas.
0. Canada.
      Ass't Examiner: Dr. William B. Hendry, Toronto, Ont.

"The practical or oral examination in Philadelphia on June 6 is scheduled to precede by one day the annual meeting of the American Medical Association.

"Candidates in Groups 2 and 3 will report to the entire Board in Philadelphia on June 6 through the direction of Dr. Edward A. Schumann of Philadelphia.

"Candidates will be notified later of the exact address at which their examinations will be held.

"For all further information address the Secretary, Doctor Paul Titus, 1015 Highland Building, Pittsburgh, Pa."

Original Communications*

THE ETIOLOGY AND SIGNIFICANCE OF NECROSIS
(INFARCTION) OF THE PLACENTA; A BIOLOGIC
AND HISTOLOGIC STUDY

By Thaddeus L. Montgomery, A.B., M.D., F.A.C.S., Philadelphia, Pa.

(From the Department of Obstetrics, Jefferson Medical College Hospital)

THE problems entailed in a consideration of the etiology and the
significance of necrosis (infarction) of the placenta are multifold.
They are closely linked to studies in embryology, physiology, and bio-
chemistry. Our views concerning them are constantly changing as our
knowledge in each branch of medical science increases.

Upon their solution a vast body of medical literature has accumulated.
During the past ten or fifteen years particularly, observations and ex-
perimental studies of such pertinence have been recorded that it now
appears worth while to scan them carefully, to abstract from each its
bit of new information and, finally, to put the whole together and
consider in what respects our understanding of the subject is to be ad-
vanced.

No space will be consumed in presenting a complete historical résumé
(a task which has been ably accomplished by Hitschmann and Linden-
thal, Clemenz, Williams and others) but attention will be called to the
publications of recent years. Quotations will be taken only from those
older contributions which are of particular significance.

Incorporated with the critical review of the literature will be found,
where they appear of value, observations of our own, which are derived
from the study of 400 consecutively delivered placentas.

Note: The Editor accepts no responsibility for the views and statements of
authors as published in their "Original Communications."

For reasons which will appear later, permission is requested to employ throughout the discourse the term "necrosis" instead of "infarction," except where quotations from others necessitate the use of the latter.

At the outset, four major problems concerning the etiology and significance of necrosis of the placenta may be tabulated:

1. The cause of the necrotic process.
2. The nature of the lesions produced and their relationship to one another.
3. The significance of hemorrhagic lesions of the placenta.
4. The relationship between toxemia of pregnancy and necrosis of the placenta.

THE CAUSE OF THE NECROTIC PROCESS

In 1921 Clemenz reviewed the literature of placental "infarction" and presented a number of reasons why the term "white necrosis," which he originally gave to the lesions in 1894, was still applicable. In the course of his paper, he discusses four basic theories of the formation of placental necrosis.

The four theories discussed by Clemenz still have their various exponents in the literature today, and may, therefore, again be used as a basis of an investigation into etiology. They are as follows:

1. Alteration of the structure of villous vessels.
2. Inflammation of the placenta.
3. Changes in the decidua and its vessels.
4. Coagulation of intervillous blood upon degenerated syncytium.

Clemenz attributes to Ackermann the origin of the name "infarction." Ackermann, Hoffman, and others ascribe the lesions to obliterative changes in the villous vessels and consider the degeneration of the syncytium and stroma as secondary.

This theory of the etiology of placental necrosis has remained deeply rooted in medical literature and teaching. Eden speaks of the "senile" changes in the placenta, the peri- and endarteritis of placental vessels, which produce "infarction" in that organ. Williams, in his various treatises on the subject, emphasizes the predominance of placental vessel change as a causative factor, but admits of the possibility of other influences, such as decidual lesions, effecting certain of the placental "infarcts."

Even those writers of recent years who attribute placental infarction to other causes are loath to repudiate completely the possibility that certain types of lesion may be due to endarteritis of placental vessels (Siddall and Hartman, Browne, McNally, Adair, McNally and Dieckmann).

Fraser attributes the alterations of the vascular tree of the "infarcted" placenta, as he observes them in roentgen-ray studies, to senile vascular changes, e.g., endarteritis and periarteritis.

On the other hand a number of observers vigorously oppose this view. Hitschmann and Lindenthal failed to observe the process of endarteritis in the placenta except in those specimens where the placenta is the site of syphilitic disease. In addition, they are of the opinion that the villous stroma and syncytium are not nourished to any extent by the villous capillaries. Clemenz is in full accord with their views. Strachan fails to find sufficient evidence of placental vessel change to explain the formation of "infarcts."

Young presents several reasons for believing that the nourishment of the villous syncytium comes from the maternal intervillous circulation and not from the fetal:

First.—That during the early stages of the development of the embryo, when the chorionic epithelium is growing, and extending rapidly, the stroma of the villi contains no fetal vessels.

Second.—In the case of hydatidiform mole and particularly of chorionepithelioma, where the chorionic epithelium is hyperplastic, few vessels are found in the mesoblastic core.

Third.—Fragments of undegenerated syncytium have been found in various organs of the pregnant woman. Such fragments transported by the maternal blood stream have maintained their vitality despite their detachment from the placental villi.

Fourth.—In ectopic pregnancy, undegenerated fragments of syncytium and villous stroma may be found, detached from the ovum, in the wall of the tube.

Fifth.—The fibrosis of the stroma and reduction of the caliber of the villous capillaries in syphilis of the placenta, do not give rise to necrosis of the overlying syncytium.

On the basis of our observations, we, too, are opposed to the theory that alterations of the villous vessels produce necrosis of the placenta. In the first place, we fail to find endarteritis of placental vessels except in fully developed syphilis of the placenta, and when this disease is present there appears to be no greater tendency to necrosis. (Fig. 10.)

In other nonsyphilitic specimens, necrosis is singularly wanting where diffuse fibrosis of the villous stroma has practically obscured the villous capillaries. (Fig. 11.)

Constantly we find villi in which the normal capillaries are distended with undegenerated blood, but around which degeneration of the syncytium and deposit of fibrin is present. (Fig. 1.)

We are of the opinion that any theory is contrary to the biologic nature of the development of the fetus in utero which pictures senile changes originating on the fetal side of the placenta. One does not find an organism so distinctly anabolic in its nature as the fetus initiating obliterative changes such as endarteritis in the vessels of its sole organ of nutrition and respiration.

We find in the placenta no type of histologic disturbance, and in the literature no proof, which justifies acceptance of the villous vessel origin of "infarcts."

The idea that the peculiar indurated areas of the placenta are the result of local inflammation of the organ was one of the first theories suggested. It is attributed by Clemenz to Mauriccan and Morgagni.

This explanation, draped in some modified form, reappears not infrequently in the literature today. Talbot in a clinical study of the placenta attributes the cause of necrosis to focal infection in other parts of the body. He believes that hematogenous transportation of bacteria produces thrombosis of uterine blood sinuses, as a result of which corresponding portions of the placenta are cut off from nutrition and undergo necrosis. His statement that "placental infarcts give more positive evidence and of greater value than blood culture methods of the presence of bacteria in the blood stream" is not supported by convincing evidence, however.
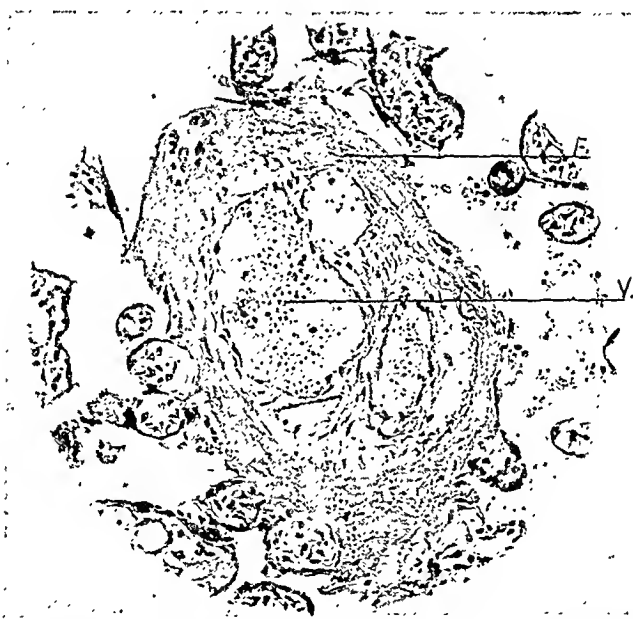
Fig. 1.—Focal necrosis of placental villus. Fibrin deposit (F) surrounding a villus in which the villous capillary (V) is distended with undegenerated fetal blood. The syncytium has disappeared. (×230)

Our histologic studies convince us that the appearance of necrotic lesions of the placenta fails to reveal any evidence of inflammatory reaction. Leucocytic infiltration of the lesions is rare.

In addition, the actual lesions of acute inflammation, which we observe in ten per cent of consecutively delivered placentas, bear no apparent relationship to the occurrence of placental "infarcts." Chronic inflammation of the placenta, as observed in fully developed syphilitic disease, is not associated with greater tendency to "infarct" formation.

The effect of thrombosis of the decidual arteries will be considered at once.

The part played by disturbances of the decidual vessels in the etiology of "white necrosis" is dwelt upon by Clemenz in his first paper

(1894). At that time he believed that obstructive lesions of the decidual arteries caused necrosis of that portion of the placenta which the vessels normally supplied with maternal blood. Although Clemenz himself apparently abandoned this theory later (1921), his original concepts are, nevertheless, frequently quoted and relied upon by subsequent observers.

We have just noted how Talbot combines this theory with the idea of focal infection as a foundation of his explanation of the inflammatory origin of "infarction."

Young attributes practically all "infarcts" to decidual vessel change, stating that when the maternal blood supply is inadequate the syncytium of the villus undergoes necrosis and fibrin is deposited in the intervillous space.

Fig. 2.—Focal necrosis of placental villi. Bridge of fibrin deposit (F.D.) which extends from the degenerated syncytium of one villus (V) to another. At one point (X) fetal blood is apparently discharging from an aperture in the capillary wall. (×230)

Siddall and Hartman consider thrombosis of the uterine blood sinuses the cause of blood stasis and thrombosis in the intervillous spaces.

Williams resorts to the original theory of Clemenz to explain the origin of certain "infarcts" which reveal upon histologic study closely matted necrotic villi unassociated with fibrin deposit.

McNally expresses his agreement with the view of Young (and therefore of Clemenz). He states further that interference with the arterial blood supply generally gives rise to nonfibrinous infarcts, while interference with the venous drainage causes stagnation and back pressure of blood and results in the formation of intra- or retro-placental hematomas.

Certain considerations make this theory of etiology appear illogical. In the first place, while acknowledging that thrombosis of the uterine sinuses may be present before the onset of parturition, we feel that the extent·to which it occurs has been exaggerated. That during pregnancy such thrombosis is sufficiently extensive to cause interference with the nutrition of corresponding areas of the placenta is extremely doubtful.

In a histologic study of fifty parturient uteri removed at time of section, Williams is not impressed with the frequency or extent of thrombosis of the sinuses at the placental site.

Recent investigations of the character of the intervillous spaces and intervillous circulation, by Runge and Hartmann, Franken, Grosser,
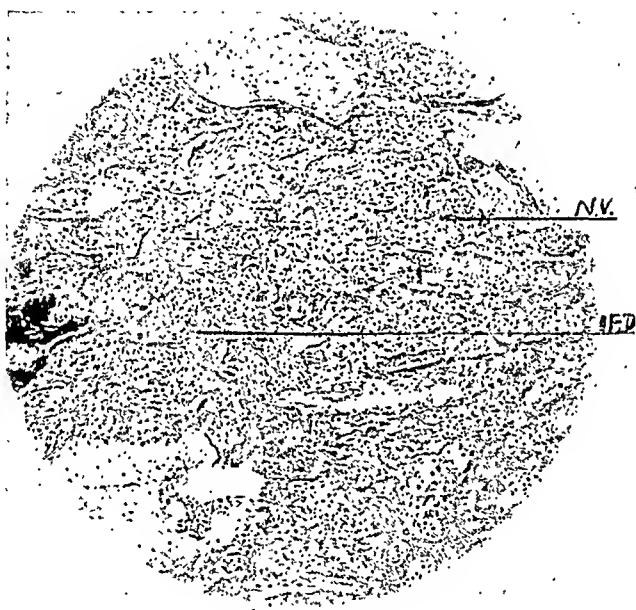
Fig. 3.—Conglomerate necrosis of placental villi. Fully developed necrotic lesion revealing necrotic villi (N.V.) and intervillous fibrin deposit (I.F.D.). (×92)

suggest that even though one or more decidual vessels are obstructed the entire placenta will nevertheless be adequately supplied with blood.

These investigators show that the decidual arteries traverse the decidual pyramids or septa to a point underneath the fetal surface where the arterial blood is discharged into a subchorial space which communicates freely between the villous stems. The blood then flows from the fetal toward the maternal surface of the placenta, pervading with slowly moving current the intricacies of the intervillous spaces. At the maternal surface it is collected by the decidual veins. (Fig. 12.)

In view of the intercommunicating nature of the subchorial space and of the intervillous circulation, it appears unlikely that obstruction of a decidual artery can cause necrosis of a contiguous portion of placental tissue. An exception to this statement follows:

The margin of the placenta which frequently reveals necrosis, as evidenced by atrophied villi and collapsed vessels, represents the transitional zone between the chorion frondosum and chorion laeve. The process of necrosis in this zone may be attributed to deficiency of the maternal blood supply from an area where the vascular decidua basalis passes over into the avascular decidua capsularis. The process here, however, is largely developmental in origin. (Fig. 9.)

The fourth theory of "infarct" formation points to necrosis of the syncytium of the villi and deposit of fibrin in the intervillous spaces as the primary etiologic factors.

Hitschmann and Lindenthal deserve the credit for advocating this theory in their excellent contribution and for describing with such exactitude the step by step development of the necrotic lesions of the placenta.
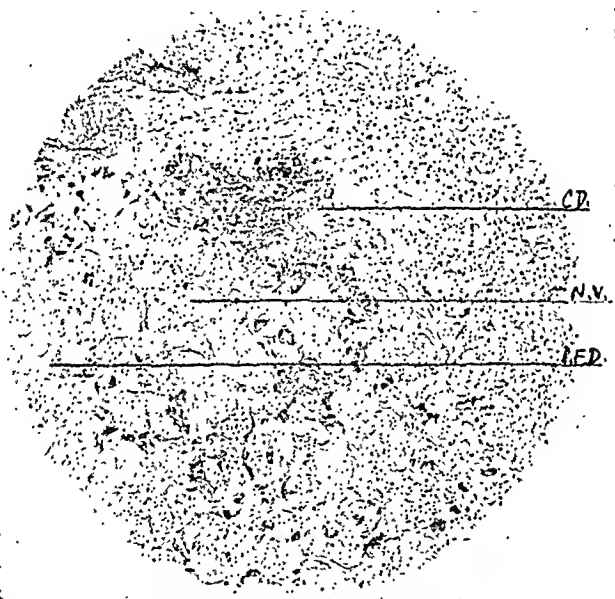
Fig. 4.—Conglomerate necrosis of placental villi with calcareous deposits. Fully developed necrotic lesion revealing necrotic villi (N.V.), intervillous fibrin deposit (I.F.D.), and calcareous deposit (C.D.). (×69)

Anatomic and physiologic considerations, as well as subsequent experimental studies, indicate that their conclusions are logical and correct. On the basis of our own observations we are in agreement with their reasoning.

What uncertainty they expressed as to whether the necrosis of the syncytium or the deposit of fibrin in the intervillous spaces is primary is now banished.

In addition, we believe that it is now possible to go further and state that a constituent or constituents of the maternal blood are responsible for degeneration of the villous epithelium, and that this process is the first step in the formation of necrotic lesions of the placenta.

For a proper understanding of this explanation of "infarct" formation one must hold in mind certain considerations. First, that while the intervillous spaces are in free communication with the maternal vessels and that although the syncytium serves the purpose of a vascular endothelium, yet this syncytium is epithelial and fetal in origin. It is in a sense foreign to the normal independent life of the host.

It is a tissue which, particularly in its early life, bears many of the characteristics of malignancy (Bell). The invasive character of the young chorionic epithelium represents the desperate effort of the fertilized ovum to secure nutrition for itself. From the first the maternal organism is on constant guard against over-invasiveness of this tissue.
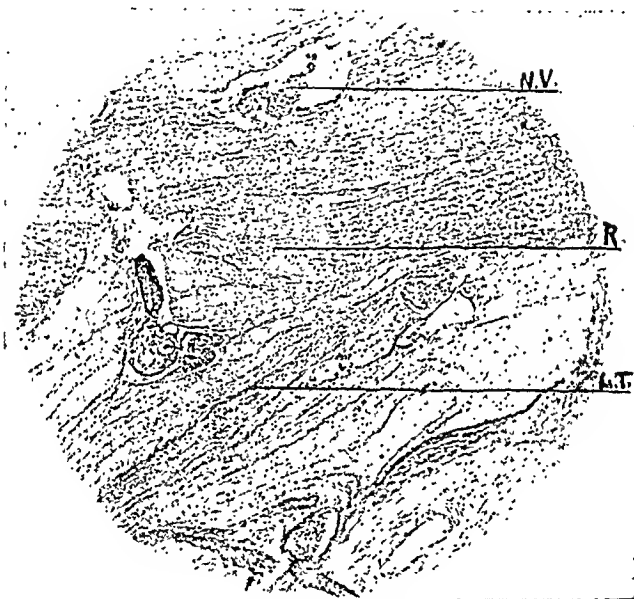
Fig. 5.—Laminated intervillous thrombosis. Blood coagulated in the intervillous space in layers (L. T.). The red blood cells (R) are still visible among the meshes of fibrin. Occasional necrotic villus (N.V.) present. (×69)

It might be said that the fetal chorionic epithelium is the one type of malignant growth against which the human host *usually* develops a mechanism of resistance. (This may break down, as in chorionepithelioma.)

During the early growth of the ovum, the decidua appears to serve this purpose of defense. At the line of contact of chorionic epithelium and decidua a "melting down" of tissue (the fibrin layer of Nitabuseh) develops.

As the growth of the embryo continues the property of resisting the growth of fetal epithelium is apparently conferred upon the maternal blood, for Langhans layer gradually disappears and toward the latter part of pregnancy the syncytium degenerates.

Hitschmann and Lindenthal call attention to the fact that as the regressive changes in the chorionic epithelium increase, necrotic and

"infarcted" areas occur more frequently in the placenta. While only small and occasional areas of necrosis are to be found in the placenta at sixteen weeks, at full term the lesions are frequent and often extensive.

When one undertakes to consider the actual constituent of the mother's blood which produces necrosis of the syncytium, he must delve considerably into the field of conjecture.

Many substances which appear to have a rather specific effect on the chorionic epithelium have been employed experimentally to produce such lesions in animals.

W. Blair Bell, and his associates, demonstrate the "specific" action of lead on the chorionic epithelium of the rabbit in contrast to the

Fig. 6.—Old necrotic lesion. Beginning disintegration and absorption of fibrin deposit (F) between the necrotic villi (N.V.) leaving a fine intervillous reticulum (I.). (×69)

effect of certain other metals. The frequency of occurrence of abortion when pregnancy is complicated by lead poisoning is well known.

Datnow presents an experimental investigation concerning toxic abortion as produced by various chemical agents.

In his experimental studies on the toxemias of pregnancy Hofbauer describes the degeneration of the chorionic epithelium and the degeneration of other viscera produced by histamine.

Francis J. Browne, in his experimental investigations into the etiology of accidental hemorrhage and placental infarction, is impressed by the degenerative changes induced in the chorionic epithelium by some toxin present in the blood of chronic nephritics.

Robert A. Johnson and his associates emphasize the degenerative effects of tyramine on certain viscera.

Whether such reactions are "specific" or whether the chorionic epithelium being embryonic in origin is more susceptible to toxic material than the maternal tissues remains to be shown. Many of the materials employed in these experiments are entirely foreign to the normal maternal circulation. In the case of others, it is questionable whether they are present in sufficient quantity to be of importance.

The constant finding of necrosis of the chorionic epithelium in all the placentas examined indicates that the process is a physiologic one. In view of what has been said of the invasive character of the chorionic epithelium and the necessity of the mother developing some mechanism of defense, it appears probable that ferments which are formed by the maternal tissues during the course of pregnancy, and transported by the maternal blood, cause the degeneration of the syncytium.

It is also highly probable that such abnormal conditions as insufficient ferment production or excessive ferment may lead respectively to such pathologic results as chorionepithelioma or widespread necrosis of the placenta.

THE NATURE OF THE LESIONS PRODUCED AND THEIR RELATIONSHIP TO ONE ANOTHER

The process of necrosis of the placenta appears to take place in the following manner.

As the degeneration of the syncytium advances all evidences of nuclei disappear from its protoplasm; the protoplasm itself becomes extremely attenuated until defects in the continuity expose the stroma of the villus. Blood platelets attach themselves to the exposed surface and fibrin is gradually deposited from the passing current of maternal blood.

The accumulating fibrin deposit soon surrounds the involved villus and frequently extends to adjacent villi. At this stage the microscopic picture reveals a single villus surrounded by fibrin, or adjacent villi joined together by fibrin. (Fig. 2.) When the process observed is recent the villous stroma may appear unaffected and the villous capillary distended with normal undegenerated fetal blood. Very soon, however, the stroma undergoes hyaline degeneration and the villous capillaries collapse. To such a lesion the term "focal necrosis of placental villi" is applicable.

A few necrotic villi connected by fibrin bands form the nucleus for more rapid growth of the lesion. Further intervillous fibrin deposit welds together large groups into a conglomerate mass. The individual villi in such a mass, deprived by encircling fibrin deposit of nutrition from the maternal blood, promptly undergo degeneration.

At this stage in the process the lesion is fittingly termed "conglomerate necrosis of placental villi." (Fig. 3.) Areas of conglomerate necrosis appear macroscopically as light grey nodules in the substance of the placenta.

When masses of necrotic villi lie adjacent to one another they obstruct the stream of maternal blood as it flows through the intervillous spaces of the placenta from the fetal to the maternal surface. In addition, fibrin ferment is constantly discharged from the degenerated tissue.

The combined effect of these two factors, stasis and fibrin ferment, is to produce in many instances extensive intervillous thrombosis of maternal blood. The thrombosis generally takes the form of lamina imposed upon the obstructing villi.

In recent thrombosis the red blood cells are entangled in the meshes of fibrin. As time goes on the red blood cells disintegrate and are absorbed. This accounts for the appearance of what have commonly
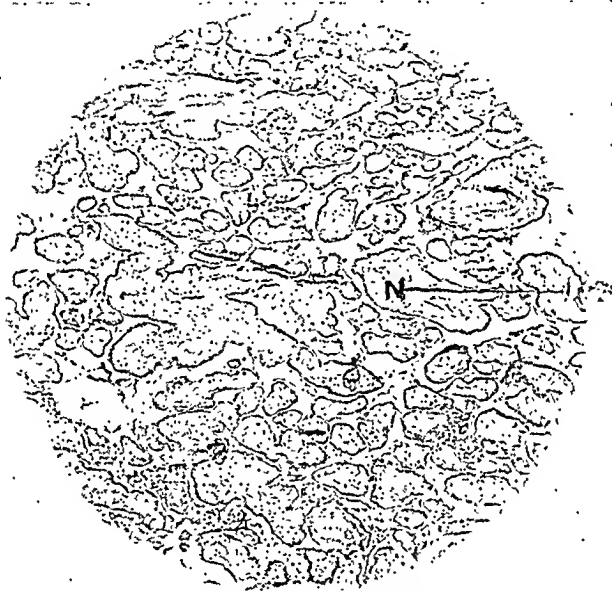
Fig. 7.—Old necrotic lesion. Further disintegration and absorption of intervillous fibrin leaving necrotic villi (N) and the appearance of a nonfibrinous lesion. (×57)

been called "red" and "white infarcts" respectively. We have chosen to call such a lesion "conglomerate necrosis of placental villi with extensive intervillous thrombosis" (Fig. 5).

Long-standing areas of necrosis may undergo certain alterations. The first and most common of these is the disintegration and absorption of the red blood cells, which has just been mentioned, and which alters the color of the lesion from red to white.

The second and not so commonly observed change is the disintegration and absorption of the intervillous fibrin deposit, which leaves pale, closely matted necrotic villi (Fig. 7). The tissue appears mummified. Grossly such areas appear lighter in color than the average lesions and contracted below the general surface of the placenta.

Siddall and Hartman describe such a lesion as the latter but attribute it to the massive obstruction of a villous stem vessel. McNally

believes such "non-fibrinous infarcts" are the result of obstruction of a decidual artery. Williams is of the opinion that such areas represent a very early stage of "infarction" and may be due to faulty decidual blood supply to the part.

We believe, however, that this lesion is an old one and is derived in the manner described. This opinion is supported by the fact that in extensive areas of necrosis we find stages of transition to this condition, and that even where the fibrin is absorbed the fine intervillous reticulum of previous thrombosis is usually retained.

The third change in old necrotic lesion, one which is infrequently observed, is the autolysis of the center of the necrotic mass with the formation of a placental "cyst."

Fig. 8.—Old necrotic lesion undergoing organization (?). Rare process; questionable in this case whether process of organization actually involves the intervillous fibrin deposit. (×276)

The fourth alteration, and one which is rarely found, is the invasion of the tissue with monocytes and the beginning of organization. (Fig. 8.)

From time to time in the course of our histologic studies, we have observed what appeared to be an outpouring of fetal blood through an aperture in the wall of the villus. This condition was noted particularly in areas where the syncytium was quite attenuated and in close contact with the endothelium of the villous capillary.

In our early studies, we were rather overimpressed with the significance of this phenomenon, thinking that extravasation of fetal blood might play an important part in the formation of extensive intervillous thrombi.

Further observations have convinced us that this is extremely unlikely. In the first place rupture of the small villous capillary alone

would liberate insufficient volume of blood to produce such large thrombotic areas. Also it appears unlikely that a central nidus of hemorrhage discharging blood into the spaces about itself could produce the peripheral extension which is characteristic of intervillous thrombosis.

In view of the studies of Allen and of Ohnesorge on the question of the isoagglutination reactions of fetal and maternal blood, it appears unlikely that the occasional isoagglutination reaction of fetal red blood cells which may escape from villous capillaries is productive of local pathology or of systemic reaction.
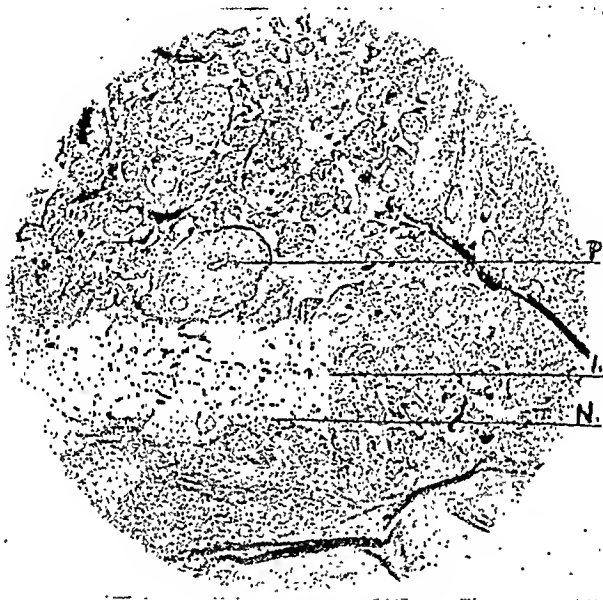
Fig. 9.—Marginal necrosis of placenta. Area in which necrosis is apparently result of inadequate decidual blood supply, revealing necrotic villi (N.), intervillous fibrin deposit (I), and collapsed placental vessels (P). (×57)

THE SIGNIFICANCE OF HEMORRHAGIC LESIONS OF THE PLACENTA

Frequently confused with large areas of necrosis of the placenta are certain true hemorrhagic lesions, or intraplacental hematomas. These are described in an excellent contribution by McNally and Dieckman, in which the successive changes in appearance from red to white are set forth. These investigators class all red "infarcts" as hemorrhagic in nature. With this viewpoint we differ, for there are many red lesions of the placenta in which the color is due not to hemorrhage but to the recent thrombosis of intervillous blood against obstructing patches of necrotic villi.

From our observations, we are of the opinion that hematomas of the placenta are a distinct entity from "infarction" of the placenta. Their formation results from the rupture of a placental vessel of sufficient size to cause a rapid extravasation of blood. Inasmuch as there is a dual blood flow, fetal and maternal, through the placenta, there are two possible sources of such hemorrhage.

Hemorrhage which results from the rupture of large vessels of the fetal circulation appears to be rare; it has never been our privilege to observe it. Klaften gathers several cases from the literature which he believes are authentically of this type. In the majority of these the hematoma was found in the subamniotic tissue of the placenta. In each case mentioned there was a history of violent abdominal trauma.

The vast majority of placental hematomas are of maternal vessel origin. Upon a consideration of recent studies of decidual and intervillous circulation (Grosser, Franken) (Fig. 12), the mechanism of formation of intraplacental hematomas is clarified. The fact that the decidual arteries follow the course of the decidual pyramids well into the thickness of the placenta makes possible the rupture of such vessels into the substance of the placenta.
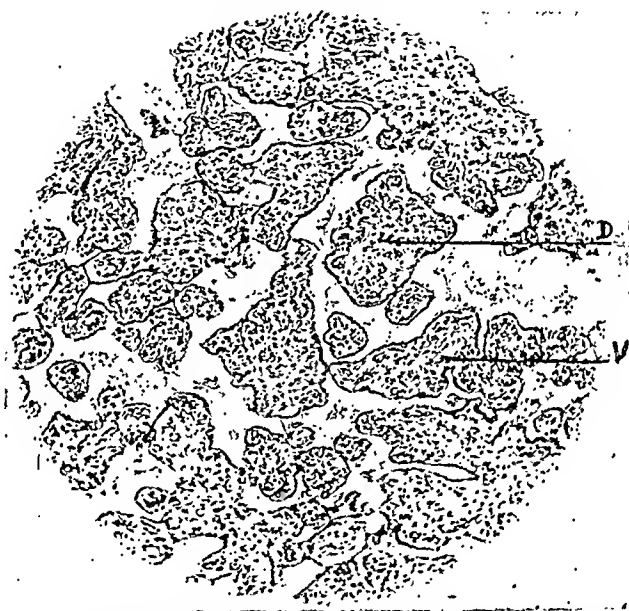
Fig. 10.—Section from syphilis of placenta. Diffuse fibrosis (D) of large placental villi resulting in reduction of the caliber of the villous capillaries (V). Singular absence of necrosis of villi. (×92)

Upon rupture of such a vessel the effect is quite in contrast to the normal condition by which blood oozes from the arterial terminals into the subchorial blood lake. Blood in large quantities and under considerable velocity discharges from a relatively large vessel into the placidly moving current of the intervillous spaces. The local intervillous circulation is incapable of coping with such a sudden extravasation. The placental villi are pushed asunder and the blood accumulates in an area surrounded by the compressed villi. Coagulation starts at the periphery and forms, with the peripherally displaced villi, a pseudocapsule.

Such hematomas appear macroscopically as dark red encapsulated lesions of more or less circular outline. As the red blood cells dis-

integrate and disappear streaks of white traverse the cut section, and eventually such areas are converted into a firm white collection of fibrin alone.

As Williams states, hematomas are particularly common in the placentas of patients who have suffered with nephritic toxemia during pregnancy; in well-marked cases the organ presents the appearance termed "placenta truffe."
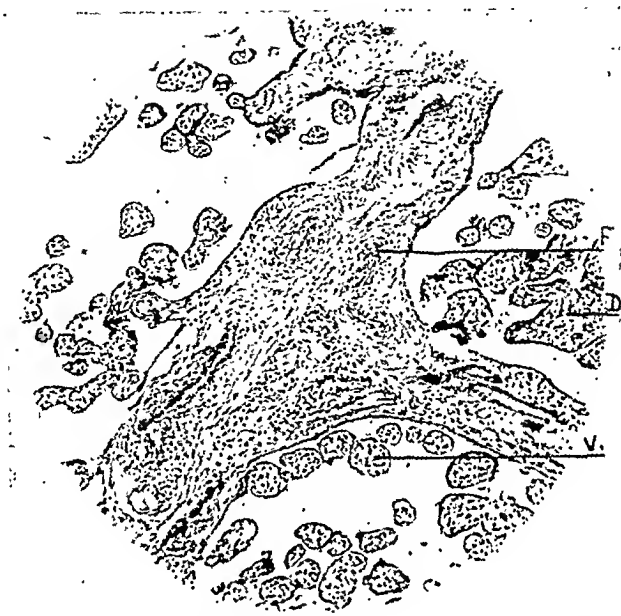
Fig. 11.—Fibrosis of placental villi and of placental vessels. Section reveals increased density of villous stroma (D) at expense of the villous capillaries (V) and increased thickness of the walls of the placental vessels (F). Singular absence of necrosis of villi. (×92)
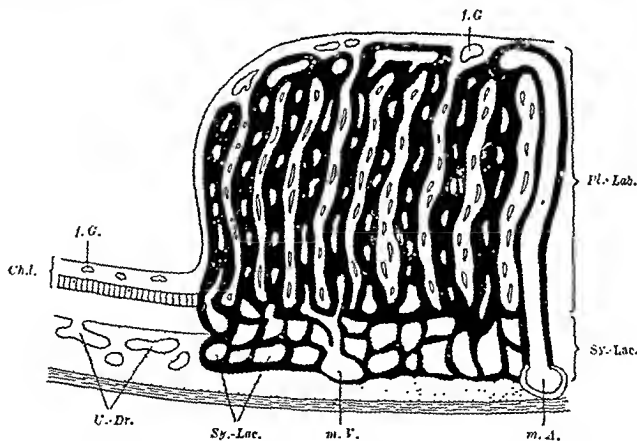
Fig. 12.—Diagram of maternal circulation through the placenta (from Grosser). The maternal blood flows through the intervillous spaces from the fetal toward the maternal surface. Decidual artery (m.A.) traversing decidual septum to fetal surface. Decidual vein (m. V.) collecting blood at maternal surface.

The association of intra-placental hematomas with uteroplacental apoplexy is frequently observed, particularly in cases of nephritic toxemia. The processes of formation of these two lesions appear to have much in common.

Francis J. Browne in his experimental investigations into the etiology of accidental hemorrhage and placental "infarction" attributes the occurrence of such lesions to the action of an "endothelial toxin" which he believes is present in the blood of nephritic patients.

He, too, emphasizes the similarity in the mechanism of production of intraplacental hematomas and of uteroplacental apoplexy, stating that the "endothelial toxin" may act on the decidual vessels either as they traverse the placenta or as they pass through the decidua basalis, or upon the endothelium of the uterine blood sinuses. That such a toxin is present in the blood of nephritic patients is possible, but remains to be proved; on the other hand, the high blood pressure alone of the nephritic patient may be a sufficiently effective force to cause rupture of the decidual vessels which are of recent and delicate formation.

THE RELATIONSHIP BETWEEN TOXEMIA OF PREGNANCY AND NECROSIS OF THE PLACENTA

The observations just recorded lead to a brief consideration of the relationship between placental necrosis (infarction) and the toxemia of pregnancy. The literature concerning this important phase of the question is greatly confused; a confusion that has in no way been relieved by the hypothesis presented by James Young, in 1926, that the products of "infarction" are causative of toxemia.

To this proposition we advance with favor the vigorous protest of Paramore, who states, "Young's conception that it is the placental change which causes eclampsia is put out of court by many considerations, for instance, by the commonness of placental infarcts without 'toxemia,' and the occurrence of marked 'toxemia,' even fulminating eclampsia, without apparent placental change."

As to the rôle played by toxemias in the production of necrosis of the placenta, no authoritative conclusion can be drawn until the nephritic patients are considered separately from the preeclamptic-eclamptic group, and until the necrotic lesions of the placenta are differentiated from the hemorrhagic.

On the basis of our observations we are in complete agreement with Williams, who states that he finds no increased tendency to "infarct" formation in the placenta of eclamptic patients. Haffner presents conclusions of a similar nature.

The lesions which Browne finds in the placentas of animals in which he experimentally produces nephritis partake primarily of a congestive and hemorrhagic nature. He states that they do not resemble the physiologic lesions of "infarction," such as are described by Eden and others.

We are of the opinion that the process of necrosis of the placenta is physiologic and that it is not produced by, nor productive of the late toxemias of pregnancy. We believe that hemorrhagic lesions (hematomas of the placenta) are, however, lesions of a different charac-

ter and etiology; they are found most frequently associated with, and are apparently caused by nephritic toxemia. They are produced by much the same mechanism as is utero-placental apoplexy.

THE TERM "NECROSIS" MORE APPROPRIATE THAN "INFARCTION"

Clemenz insists that the title "necrosis" of the placenta is alone applicable to these degenerative lesions. With this we agree to a considerable extent, although finding no reason to limit the term to "white necrosis."

It is not to be denied, however, that in the fully developed lesions certain points common to infarction are to be found (MacCallom). This is particularly true, in that intervillous thrombosis prevents the maternal blood from reaching the villi and causes their death by starvation.

Nevertheless, the process of formation is not similar to that of infarction in other organs and the use of the term "infarction of the placenta" immediately suggests an embolic phenomenon, which is a gross misconception.

The title "necrosis of the placenta" indicates more aptly the origin of the lesion in the initial degeneration of the syncytial covering of the placental villi. For this reason we strongly recommend its employment.

SUMMARY

In a brief summarization of our studies we would emphasize the following points:

1. Necrosis of the placenta is a physiologic phenomenon and is found to some degree in every full-term placenta.

2. The process is initiated by degeneration of the syncytium and deposit of fibrin in the intervillous space.

3. It appears likely that during pregnancy ferments are formed by the maternal tissues as a protection against the invasive character of the chorionic epithelium, and that these ferments, as constituents of the maternal blood, cause degeneration of the syncytium.

4. The successive stages in the progress of necrosis of the placenta are: "focal necrosis of placental villi," "conglomerate necrosis of placental villi," "conglomerate necrosis of placental villi with extensive intervillous thrombosis."

5. Long-standing areas of necrosis may undergo the following alterations:

    1. Disintegration and absorption of the red blood cells, which alters the color of the lesion from red to white (common).

    2. Disintegration and absorption of intervillous fibrin deposit leaving pale, closely compacted, necrotic villi (not uncommon).

    3. Autolysis and cyst formation in the center of the necrotic tissue (infrequent).

    4. Invasion with monocytes and beginning organization of tissue (rare).

6. Hematomas of the placenta are not of the same nature as the necrotic lesions of the placenta. Hematomas result from the rupture of

decidual arterioles. They occur most frequently when pregnancy is complicated by chronic nephritis. Their etiology and mechanism of formation are similar to that of uteroplacental apoplexy, and the two lesions may be found in the same placenta.

7. Necrosis of the placenta is found no more frequently in toxemia of pregnancy than in normal pregnancy. There is insufficient evidence for the statement that "infarcts" of the placenta cause toxemia of pregnancy.

Hemorrhagic lesions (hematomas) of the placenta, however, are associated with nephritic toxemia.

8. The term "necrosis" is preferred to "infarction" because, as has been demonstrated, the process begins with small areas of tissue death rather than with obstruction of circulation.*

REFERENCES

Adair, Fred L.: Am. J. Obst. & Gynec. 6: 552-556, 1923. *Allen, Wilmar M.:* Bull. Johns Hopkins Hosp. 38: 217-226, 1926. *Bell, W. Blair, Hendry, R. A., and Annet, H. E.:* J. Obst. & Gynec. Brit. Emp. 32: 1-16, 1925. *Bell, W. Blair, Brooks, J., and Jowett, M.:* J. Cancer Research 12: 369-391, 1928. *Browne, Francis J.:* (Preliminary Communication) British M. J. 1: 683-687, 1926. *Browne, Francis J., and Dodds, Gladys H.:* J. Obst. & Gynec. Brit. Emp. 35: 661-692, 1928. *Clemenz, Eduard:* Ztschr. f. Geburtsh. u. Gynäk. 84: 758-770, 1921-1922. *Datnow, Morris W.:* J. Obst. & Gynec. Brit. Emp. 35: 693-724, 1928. *Davis, James E., Kellog, B. V., and Amolsch, Arthur L.:* Am. J. Obst. & Gynec. 7: 637-658, 1924. *Eden, Thomas Watts:* J. Path. & Bacteriol. 6: 265-283, 1896-1897. *Frank, Robert Tilden:* Gynecological and Obstetrical Pathology, New York, 1922, D. Appleton & Co. *Franken:* Arch. f. Gynäk. 137: 743-747, 1929. *Frankl, Oskar:* Monatschr. f. Geburtsh. u. Gynäk. 57: 244-246, 1922. *Fraser, John:* Am. J. Obst. & Gynec. 6: 645-655, 1923. *Grosser, O.:* Arch. f. Gynäk. 137: 681-689. *Haffner, Raymond:* Gynec. et Obst. 3: 81-89, 1921. *Hitschmann, J., and Lindenthal, Otto Th.:* Arch. f. Gynäk. 69: 587-629, 1903. *Hofbauer, J.:* Am. J. Obst. & Gynec. 12: 159, 1926. *Jaschke, Herr V.:* Arch. f. Gynäk. 137: 708-710, 1929. *Johnston, Robert A., Johnson, Herman W., and Nicholas, H. O.:* Texas State J. Med. 25: 515, 1929. *Khreninger, J. von:* Monatschr. f. Geburtsh. u. Gynäk. 80: 104-108, 1928. *Klaften, E.:* Arch. f. Gynäk. 139: 76-87, 1930. *Loehhead, James:* Chapter 10 from the Physiology of Reproduction, Marshall, London, Longmans, Green and Co. *Loeser:* Arch. f. Gynäk. 137: 730, 1929. *MacCallum:* A Textbook of Pathology, ed. 3, Philadelphia, 1924, W. B. Saunders Co. *McNally, F. P., and Dieckman, Wm. J.:* Am. J. Obst. & Gynec. 5: 55-66, 1923. *McNally, F. P.:* Am. J. Obst. & Gynec. 8: 186-194, 1924. *McQuarrie, Irvine:* Bull. Johns Hopkins Hosp. 34: 51-59, 1923. *Ohnesorge, V.:* Zentralbl. f. Gynäk. 49: 2884-2890, 1925. *Paramore, R. H.:* J. Obst. & Gynec. Brit. Emp. 35: 292-306, 1928. *Runge, H., and Hartmann, H.:* Arch. f. Gynäk. 139: 51-56, 1930. *Siddall, R. S., and Hartman, F. W.:* Am. J. Obst. & Gynec. 12: 683-699, 1926. *Strachan, Gilbert I.:* J. Obst. & Gynec. Brit. Emp. 30: 611-642, 1923. *Strachan, Gilbert I.:* J. Obst. & Gynec. Brit. Emp. 32: 89-109, 1925. *Strachan, Gilbert I.:* J. Obst. & Gynec. Brit. Emp. 33: 262-284, 1926. *Talbot, John E.:* Surg. Gynec. Obst. 32: 552-556, 1921. *Waugh, Theo. R.:* Canada M. J. 18: 64-66, 1928. *Williams, J. Whitridge:* Am. J. Obst. 41: 775-801, 1900. *Williams, J. Whitridge:* Obstetrics, New York, 1924, D. Appleton & Co. *Williams, J. Whitridge:* Bull. Johns Hopkins Hosp. 28: 335-343, 1917. *Willson, Prentiss:* Surg. Gynec. Obst. 34: 57-77, 1922. *Young, James:* J. Obst. & Gynec. Brit. Emp. 26: 1-28, 1914. *Young, James:* Tr. Edinburgh Obst. Soc., pp. 61-76, 1926-27.

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MANAGEMENT OF THE THIRD STAGE OF LABOR WITH SPECIAL REFERENCE TO BLOOD LOSS

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IN A PRELIMINARY report by one of us (AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY 17: 578, April, 1929) the "Blood Loss in the Third Stage of Labor," was analyzed with the idea of determining what clinical factors had a bearing in determining the amount lost in each given case. This analysis proved very suggestive but was not entirely conclusive because of the small size (868 cases) of the series available for study. The present paper is the result of a similar analysis of[1] some 3000 cases from the University of Minnesota and[2] 1200 private patients from the Henry Ford Hospital, along with[3] some 1400 cases from the University of Virginia and the University of Kansas. These three series provide a total of 5600 cases and offer an opportunity for comparative analyses between clinic and private practice, as well as between two different teaching clinics where there exist certain differences in types of material and also certain differences in technic.

Two simple methods of analysis are employed in this study. Each of these methods was applied separately to each of the three series of cases. No attempt was made to analyze the composite group of 5600 because of the character of the material. A series of private cases, with expert attendants, would obviously present a different picture from a group of clinic cases routinely attended by interns. Likewise the University of Minnesota Clinic differs essentially from that at Virginia and Kansas. At Minnesota the routine attendants at deliveries are the intern and the junior Teaching Fellow, and the patients are largely white and Scandinavian. At Virginia and Kansas the routine attendants are the intern and a visiting man or senior resident, and there is a considerable admixture of colored patients along with a white stock of somewhat smaller stature than the Scandinavian.

The first method of analysis was to graph blood loss against each of the clinical factors studied. In every instance blood loss was plotted, as ordinate, against the factor being studied, as abscissa. Average points only were plotted as it was felt that field graphs would not add materially to the value of the study. No attempt was made to smooth out any of the resulting curves. They are presented as broken lines.

The second method of analysis was the same as that employed in the preliminary report, namely Pearson's Coefficient of Correlation. This

latter method is superior to the former in that it shows much more definitely the exact relationship present but it does possess the disadvantage of not being quite as readily understood, as, so far, it has not been widely used in medicine. On the whole, the results obtained with these two methods of study are almost identical. They therefore corroborate one another and, for our present purposes, enable us to draw somewhat more definite conclusions.

AGE OF THE MOTHER

Fig. 1 shows the resulting curves from plotting blood loss in cubic centimeters against age of the patient (in three-year intervals) in
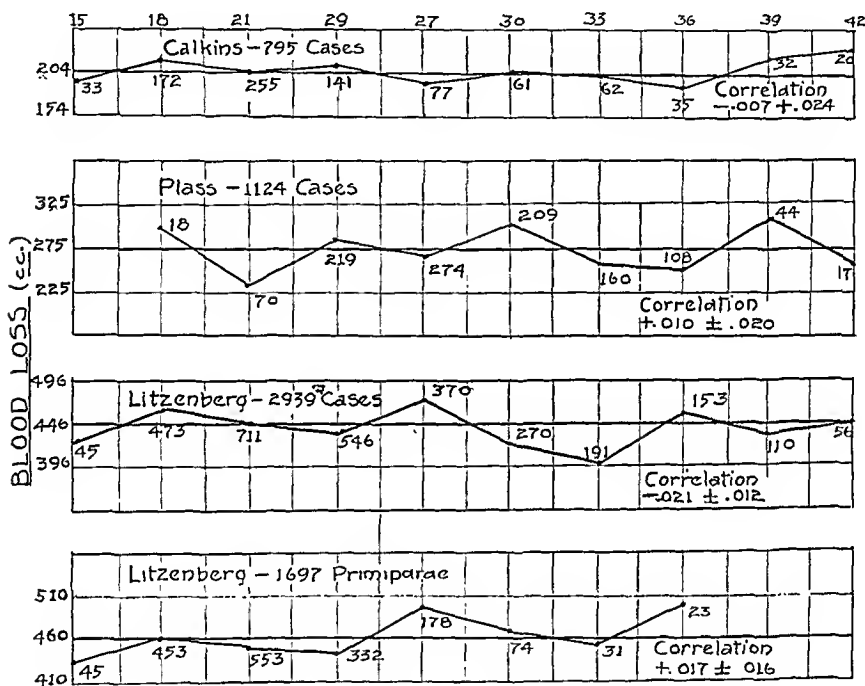
Fig. 1.—Showing age of mother.

each of the three series. Because of the fact that patients in the younger age groups are almost all primiparae and the patients in the older age groups are almost all multiparae, and considering that blood loss in primiparae is slightly greater than that in multiparae, it was thought advisable to plot a fourth curve covering primiparae only, in order to remove the differential of parity from the analysis of age. The coefficient of correlation accompanies each graph and it may be noted that absolute agreement exists between the graph and the coefficient in each case. Each graph is a flat line with no tendency to increase or decrease as one passes from the younger to the older age groups. Each coefficient is essentially zero and in no instance is it materially more than its probable error. It is quite evident that age of the patient has no effect on the amount of blood lost.

Certain errors in copying clinical histories of the Plass group prevented the analysis of parity in that series. Only two curves and their corresponding coefficients are therefore available for study. The curves present the same characteristics as those on age, in that there is no definite tendency toward increase or decrease in the blood loss as one passes from the first to the tenth pregnancy. There were not sufficient numbers of cases to enable us to analyze parity beyond the tenth pregnancy. The coefficients are slightly higher, seeming to indicate a decrease in blood loss with increasing parity. This tendency as shown by the coefficients is very small. Feeling that it was probably limited
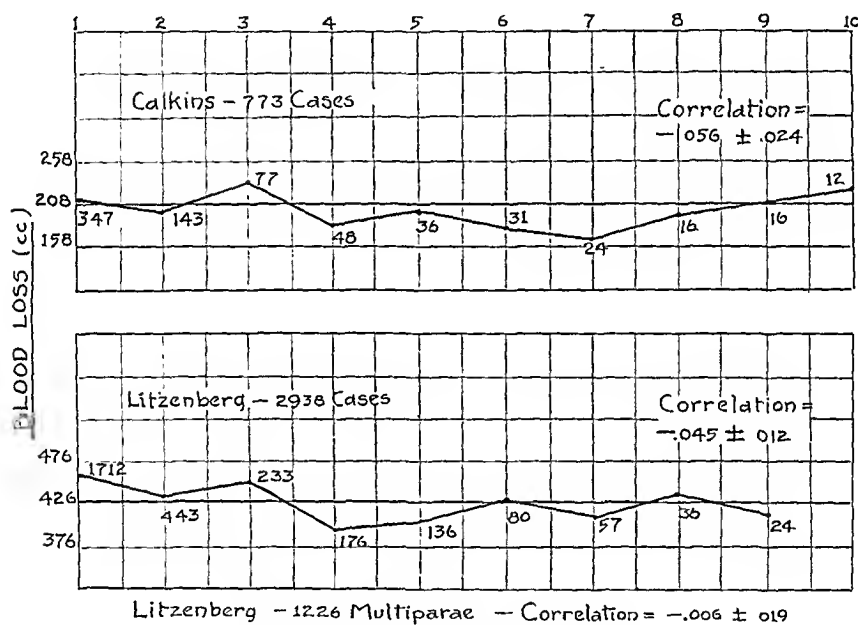
Fig. 2.—Showing parity of mothers.

to the decrease between gravida one and gravida two (note the comparatively large number of cases in each of these two groups) the coefficient for the 1226 Minnesota multiparae was also determined. It proved to be zero, thus establishing clearly what seemed to be true from inspection of the graphs alone and bringing the coefficients and graphs once more into perfect agreement. (Fig. 2.)

This difference in blood loss between the first and subsequent labors is really quite small and actually proved to 33 c.c. in the Litzenberg series and 12 c.c. in the Calkins series. These amounts are well within the difference between a first degree and second degree laceration (41 c.c.) as mentioned in the preliminary report. They are, therefore, to be explained on the basis of greater frequency of laceration in the primiparae. Remembering, then, that there may be some extra bleeding

from lacerations in the primiparae one can safely draw the conclusion that, in other respects, parity has no effect on blood loss.

LENGTH OF LABOR

First Stage (Fig. 3).—Analysis of the length of the first stage of labor in three-hour intervals showed curves and coefficients with very slight or no tendency toward increase in blood loss in the longer labors. In the Calkins and Litzenberg series both the curves and the coefficients indicate a very slight tendency toward increase. This is not true in the Plass series as the curve is flat and the coefficient is less than twice its probable error. This tendency, if present, is so small that it cannot
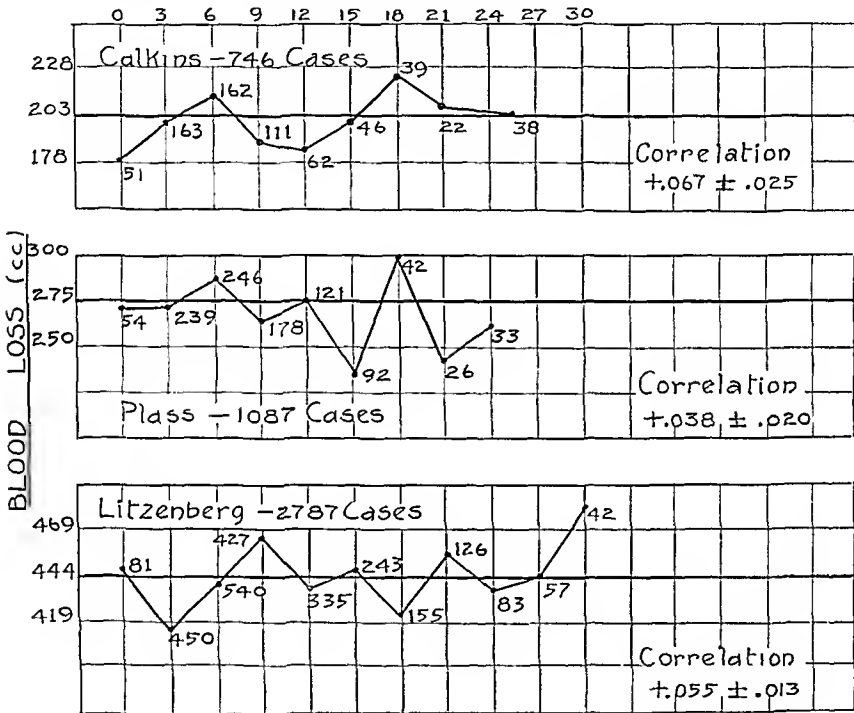
Fig. 3.—Showing length, in hours, of first stage of labor.

possibly have any bearing determinable in the individual case. One may, therefore, draw the conclusion that the length of the first stage of labor has no appreciable effect on the blood loss of the third stage.

Second Stage (Fig. 4).—The tendency toward upward inclination of the blood loss in the cases with a longer second stage of labor is somewhat more evident than was true of the first stage. Looking at the curves as a whole, however, this tendency is not very marked. The coefficients, with the exception of the Calkins series, are not large. When one recalls that forceps delivery with its frequent episiotomy or second degree laceration is much more common with a long second stage than with a short one and then remembers that operative delivery materially increases the blood loss this upward tendency in the curves

becomes of little significance. The *average increases* in blood loss from forceps delivery and from lacerations are shown in Table I.

<div align="center">TABLE I</div>

	CALKINS	PLASS
Low forceps	90 c.c.	} 100 c.c.
Median forceps	230 c.c.	
First degree laceration	none	45 c.c.
Second degree laceration	40 c.c.	70 c.c.
Episiotomy	70 c.c.	55 c.c.

When one analyzes spontaneous deliveries separately one finds no definite tendency toward increased blood loss with prolongation of the second stage (coefficient is +.060 ±.032). It is probably safe to conclude
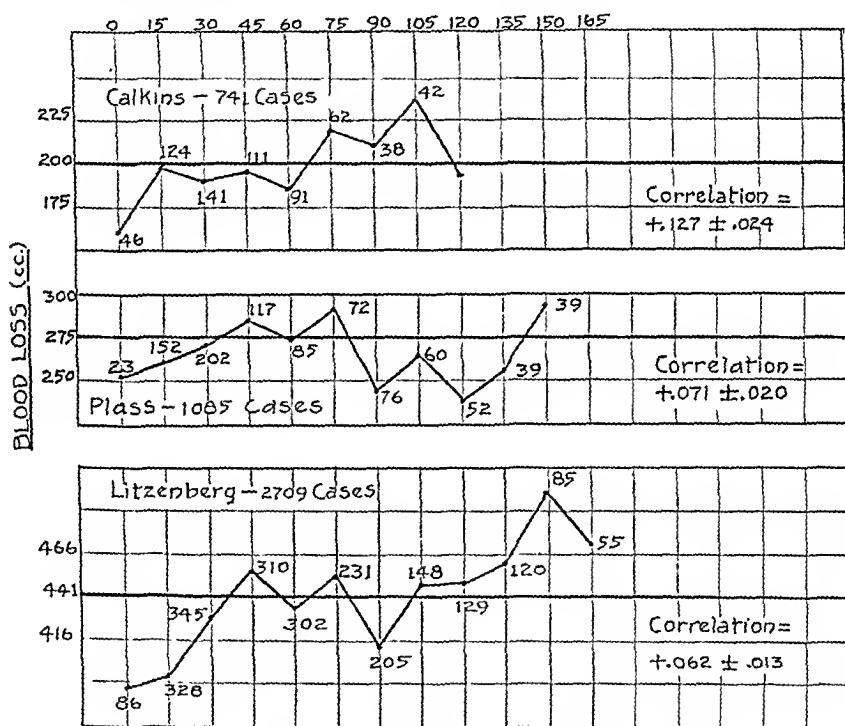
Fig. 4.—Showing length of second stage, in minutes.

that the length of the second stage of labor (without operative interference) has no particular effect on the blood lost. This is certainly true as far as application to the individual case is concerned.

Third Stage (Fig. 5).—Here we find a very definite tendency toward increased blood loss with the longer durations of this stage of labor. This tendency is evident in each of the three curves and also in each of the three coefficients. In the Litzenberg series the increased blood loss amounts to about 150 c.c. for a forty-minute third stage as against a real short third stage. The coefficients vary from five times the probable error in the Calkins series to eleven times the probable error
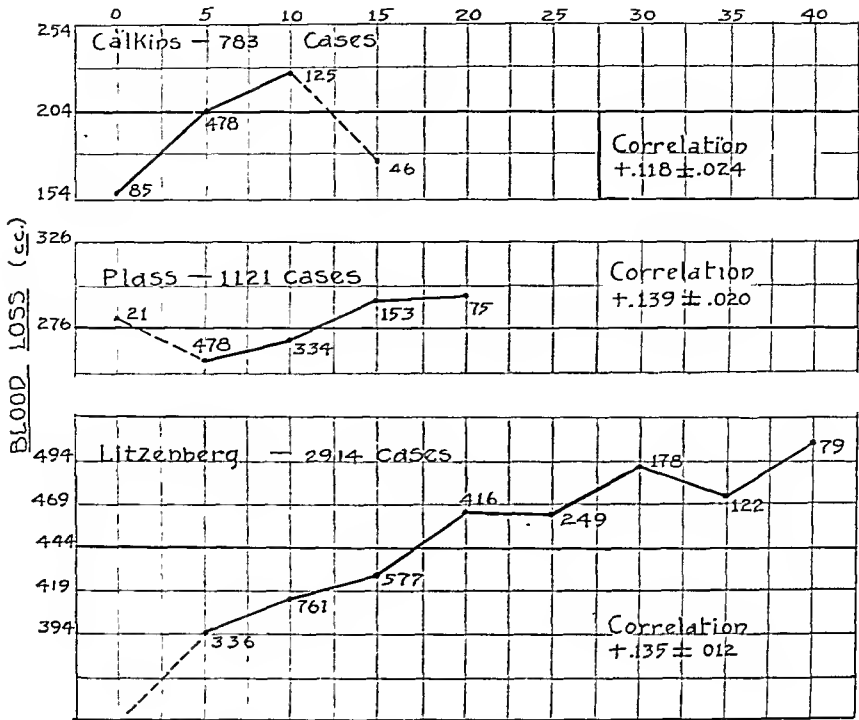
Fig. 5.—Showing length of third stage, in minutes.
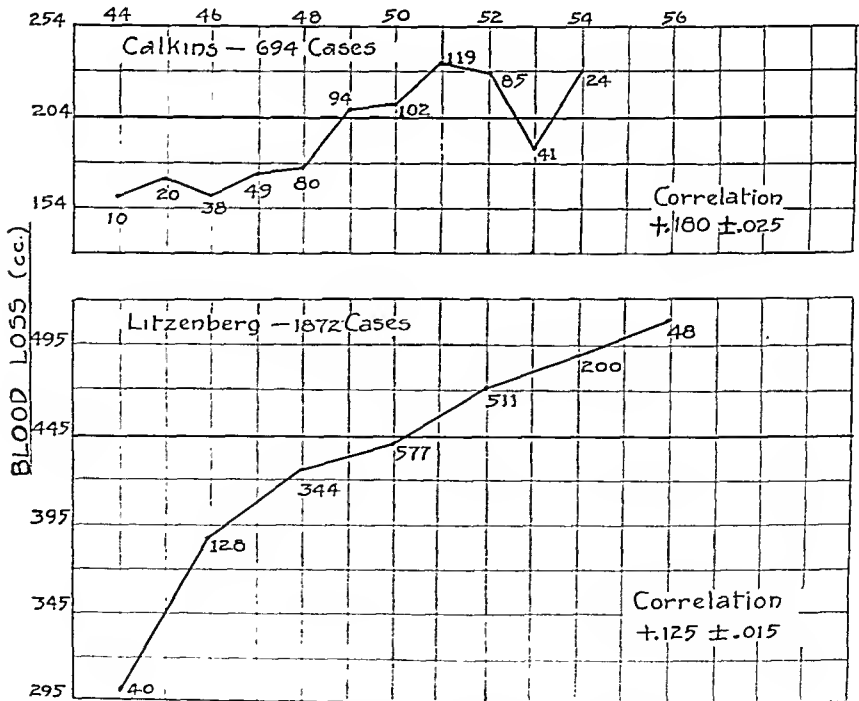
Fig. 6.—Showing height of child in centimeters.

in the Litzenberg series and are all well over +.100. This tendency toward increased blood loss with prolongation of the third stage is sufficiently definite to make itself felt in a practical way in the individual patient. One may find, of course, numerous exceptions but they are not sufficiently frequent to disprove the general statement. Moreover, good management of a prolonged third stage can nullify, and, no doubt, frequently does prevent the occurrence of excessive blood loss
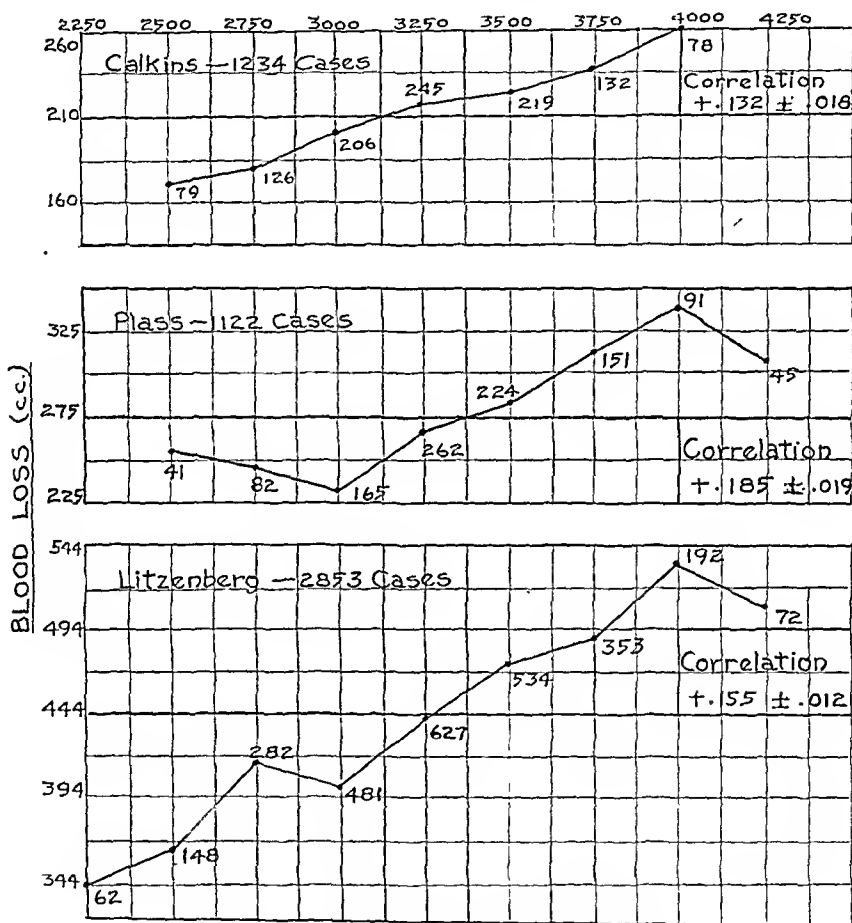
Fig. 7.—Showing weight of child, in grams.

in a long third stage. The point to be gained in this discussion is that, other things being equal, a short third stage is more apt to result in a small blood loss than is a long third stage.

SIZE OF CHILD

Fig. 6 shows a very definite relationship between the height of the child in centimeters and blood loss in cubic centimeters. There is a very definite upward trend in the curves, this being perhaps more marked in the Litzenberg series than in the Calkins series. The co-

efficient, however, is large in both instances, being seven times its probable error in one case and eight times its probable error in the other.

Similar results are shown in Fig. 7 concerning the weight of the child. A definite upward trend in the curve of each of the three series is present. The correlation coefficient varies from seven times its probable error to thirteen times its probable error. It is interesting to note that analysis of primiparae and multiparae separately (Fig. 8) shows that weight of the baby is a much more important item in determining
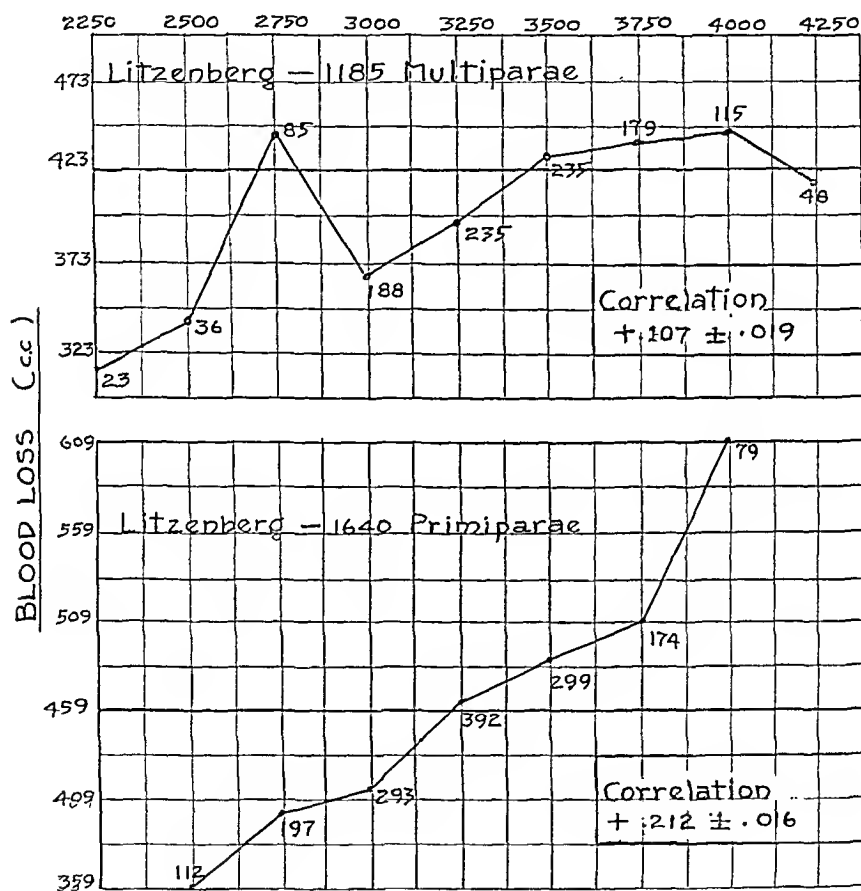
Fig. S.—Showing comparative weights of children in multiparae and primiparae.

blood loss in the first labor than it is in subsequent labors. The pitch of the curve for primiparae is approximately twice as steep and the coefficient twice as great as the corresponding figures for multiparae. Size of the child, then, is a rather important factor in determining blood loss. Ahlfeld has previously called our attention to this relationship.

MISCELLANEOUS

Length of Pregnancy.—Fig. 9 reveals a rather definite connection between the length of gestation and the blood loss. The pitch of the curves

and the size of the coefficients are, however, not as great as those for height and weight of the child. It is probable, therefore, that length of pregnancy has a bearing on the blood loss only in that with longer pregnancies the child is larger and for practical purposes we need not consider the length of pregnancy but rather the size of the child.

Size of the Placenta (Fig. 10).—Whether one considers the weight of the placenta or the area of its maternal surface one finds a rather definite relationship between size of the placenta and blood loss. Here
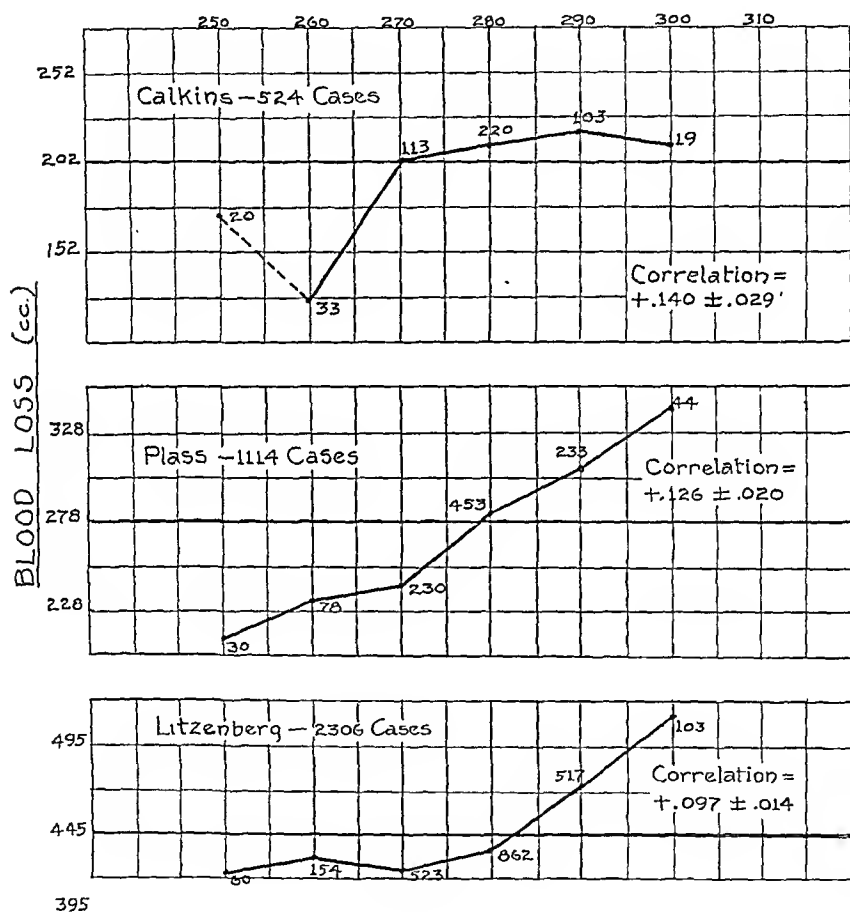
Fig. 9.—Showing length of gestation, in days.

again placental size seems to be more important in the primiparae than it is in the multiparae. In fact, the relationship in multiparae might be subjected to a slight doubt as the coefficient is only five times its probable error. Ahlfeld also noted the relationship between size of the placenta and blood loss.

Stature of the Mother.—Height and weight of the mother was found to have some considerable bearing on blood loss as stated in the preliminary report. Size of the pelvis was thought not to be a factor. No additional data is available at the present time.

SUMMARY

It would seem from the foregoing that age and parity have no effect on the blood loss at delivery. Length of labor, except for the length of the third stage, has also no demonstrable influence. The important and
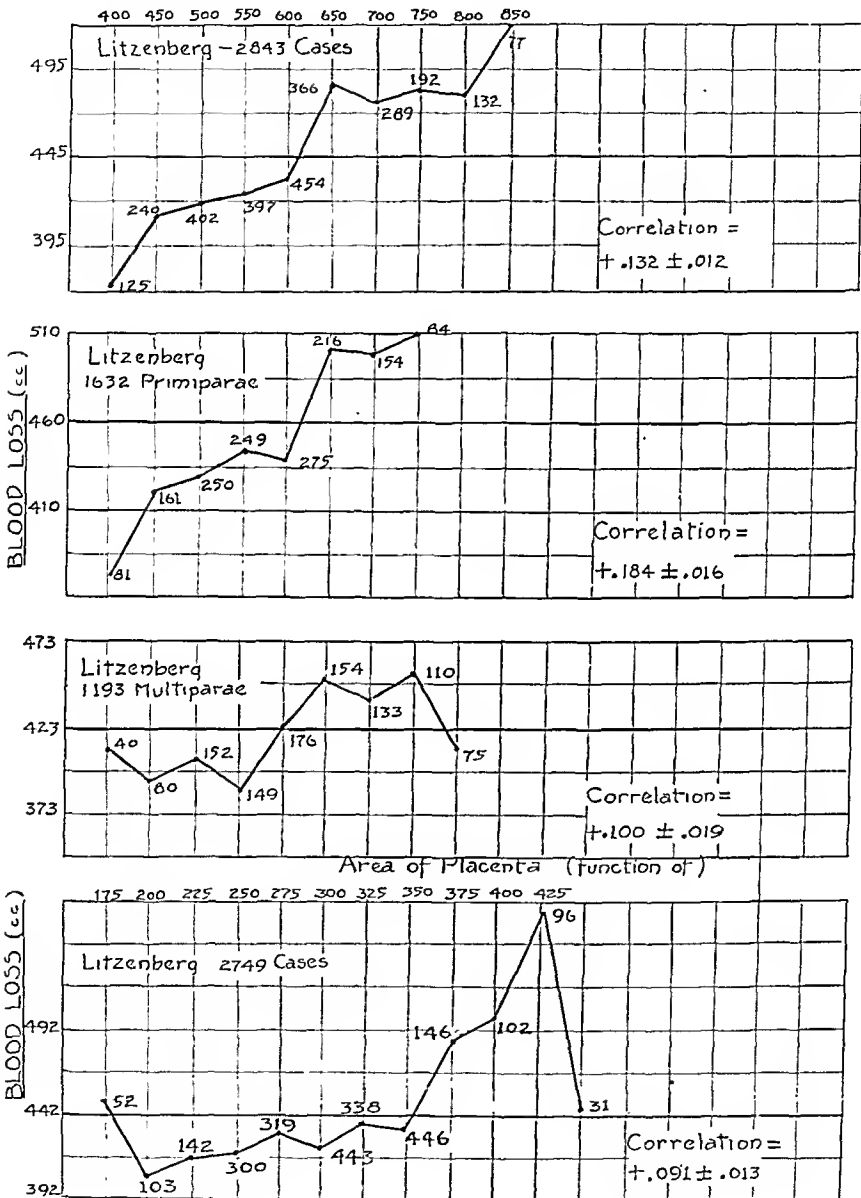
Fig. 10.—Showing weight of placenta in grams.

uncontrollable factors materially influencing blood loss are stature of the mother and stature of the child. These, along with duration of the third stage of labor, seem to account for most of the variation in blood loss in women delivered spontaneously and without severe laceration.

MANAGEMENT OF THE THIRD STAGE OF LABOR

There seems to be no difference of opinion on the point that there is no blood loss until after placental separation and that attempts to express the placenta before it is completely separated are ill advised. In order to have perfectly reliable information on the question of the duration of the third stage one should really study that portion of the third stage between the time of separation and the time of expulsion of the placenta. Inasmuch as there are no data on this point in any of the three series of cases studied this must remain a matter for future investigation. It seems quite likely that a very close relationship will
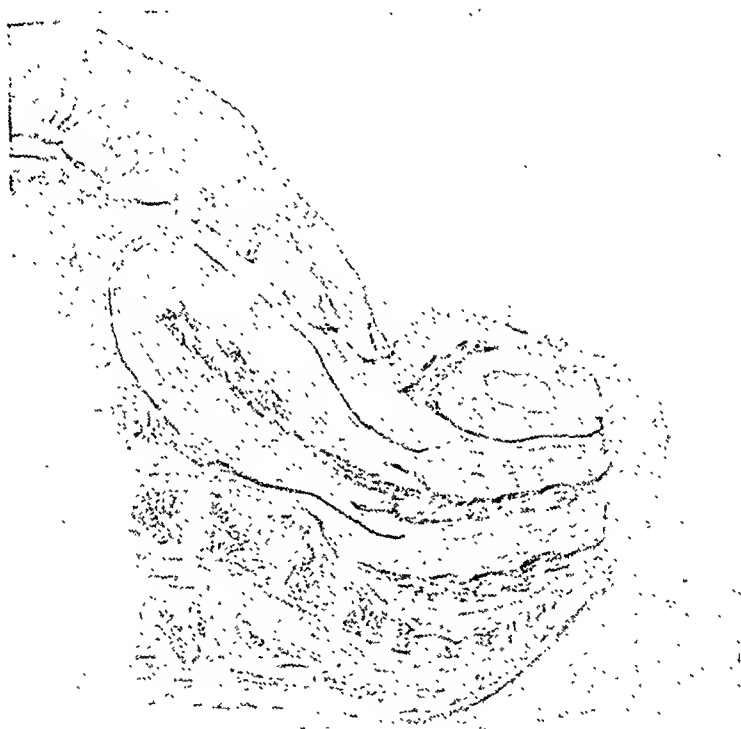
Fig. 11.

be found between the duration of this latter part of the third stage and the amount of blood lost. It would seem that several clinicians have come to this conclusion from clinical observation. The technic, or management, of the third stage of labor, as practiced by them, stresses the necessity for expulsion of the placenta as soon as it is definitely separated. Authorities are agreed that it is necessary to express the placenta from the lower genital tract in the vast majority of cases. The technic of this expression is of some importance. Squeezing the uterus would seem to be of equal importance to downward pressure. In fact, too much downward pressure should be avoided. We agree with Watson that, ''in cases where forcible attempts at expulsion of the placenta are made in such a way as to push the uterus down into

the pelvis and make the cervix actually protrude at the vulva there is a grave danger of infection.'' The massage, so often necessary following the delivery of the placenta, should also be performed with care. It is suggested that *massage from side to side on the anterior aspect* of the body of the uterus below the fundus (Fig. 11) is preferable in that (1) it is quite as effective in producing contraction of the uterus and (2) it tends to keep the uterus up out of the pelvis. Both before and after the separation and delivery of the placenta it seems quite necessary that the attendant or his assistant *keep the hand constantly on the uterus* as there are numerous cases where marked softening and enlargement of the uterus will take place in the space of a few seconds' time. Such a softened and enlarged uterus is often quite difficult to handle in that it does not respond readily to massage or to the use of drugs and, consequently, there is a considerable blood loss before the uterus is again brought into firm contraction.

We should like to suggest the following technic for the management of the third stage of labor:

Immediately upon the birth of the baby the fundus is carefully located by the obstetrician, or an assistant, and is *held constantly until the placenta is separated and expressed and bleeding thoroughly controlled. Care is taken not to massage the uterus unless there be evidence of considerable softening or actual bleeding.* Of the signs of placental separation beginning bleeding (excluding cervical bleeding) would seem to be the most important. As soon as there is evidence of placental separation, the organ should be expressed by squeezing the uterus and making moderate downward pressure. This separation of the placenta takes place in the large majority of cases in from one to five minutes. Immediately following the delivery of the placenta firm contraction of the uterus should be produced by (1) the administration of pituitrin, hypodermically, and (2) moderately vigorous massage of the uterus. This massage is probably more important than the pituitrin. The uterus should be watched closely for at least one hour following delivery. Ergot may also be given (hypodermically?) at the discretion of the obstetrician. At the end of one hour all clots should be expressed from the uterus and vagina.

It is believed that this technic, carefully carried out, should result in an average loss of not more than 150 cubic centimeters of blood.

REFERENCES

Ahlfeld: Ztschr. f. Geburtsh. u. Gynäk. 51: 341, 1904. *Calkins, L. A.:* Am. J. Obst. & Gynec. 17: 578, 1929 and Trans. Am. Assn. Obst. Gynec. and Abd. Surg., 1928. *Freeland:* Tr. Am. Assn. Obst. & Gynec. 26: 448, 1913 and 1914. *Polak, J. O.:* Surg. Gynec. Obst. 21: 590, 1915. *Tucker:* Am. J. Obst. & Dis. Women 12: 569, 767, 1898. *Watson, B. P.:* Am. J. Obst. & Gynec. 16: 536-546, 1928. *Williams, J. W.:* Am. J. Obst. and Dis. Women 80: 1, 1919 and Contribs. to Med. and Biol. Research, Paul Hoeber, New York 2: 1238, 1919.

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A COMPARISON OF THE RESULTS OF SURGERY AND OF RADIATION IN THE TREATMENT OF CANCER OF THE CERVIX

AN ANALYSIS OF 200 CASES SUBJECTED TO RADIATION TREATMENT

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GENERAL DISCUSSION

A REVIEW of 325 cases of carcinoma of the cervix in which the patients were examined, treated, and observed personally between the years 1920 and 1929, inclusive, discloses the fact that in the cases seen in 1929 the disease was just as far advanced as in those seen in 1920, notwithstanding the numerous articles which have been written on the subject and the publicity given it by the Society for the Control of Cancer.

It has been correctly stated that for many years women have refused operation for cancer of the cervix because they felt that it was useless because of the frequent early recurrence. The extensive, successful use of radium within the past ten years should have eliminated this objection, but nevertheless the fact still remains that patients with this condition are presenting themselves too late for a cure to be accomplished. Moreover, the attempt to treat these advanced cases with radium has had a tendency to bring this method into disrepute because the pain with which the late stages of the disease are attended is believed by the laity to be due to a radium burn. For this reason many patients refuse radium treatment.

In most cases thorough questioning reveals the fact that the patient did consult a physician from four to six months before the disease was recognized and proper treatment instituted. If a patient consults her family physician because of some supposed menstrual disorder, he must assume the responsibility and convince himself by a thorough examination that there is or is not an existing pathologic condition; and if there is, the patient should be treated promptly. Consultation without proper examination leaves the patient with a false sense of security which leads to a delay of several months.

Investigation has also disclosed the fact that simple hysterectomy for carcinoma of the cervix is still in vogue in many smaller localities, whereas in most of the larger towns and clinics throughout the country it is generally conceded that radium and x-ray are the preferred methods of treatment. It would seem that ease of communication through medical

meetings and journals in the present age should have accomplished more than it has during the past ten years.

I think it quite safe to assume that the major controversy regarding the relative merits of surgical and radiation treatment for cancer of the cervix is settled. It is generally agreed that surgery is excellent treatment for early cases, but these are so few as to be almost disregarded. It is also quite fair to say that radiation will cure as many of the early cases as will surgery, without any mortality or morbidity.

Before the Medical Society of the State of New York in 1920, Reuben Peterson presented a paper on "Radical Abdominal Operation for Carcinoma of the Cervix" in which he reported that 40.09 per cent of his patients who were operated upon were permanently cured. However, he operated upon only 60 of 380 patients. In reality, 18 patients, or 4.7 per cent of the whole number, were cured. Fourteen died as the immediate result of operation. In view of present-day statistics, it is quite clear that if this group of 380 patients had been treated with radiation, the percentage of cures would have been considerably higher.

Wertheim, who developed the radical operation for carcinoma of the cervix and whose experience is greater perhaps than that of any other surgeon, found an operability of 48 per cent and was able to effect a five-year cure in 18.04 per cent. This means that out of 100 patients seen, 48 were operated upon. Allowing for a minimum mortality of 12 per cent, 42 patients would survive operation. Eighteen per cent of these patients were cured, which in reality means 9 out of the original 100 cases.

Norris, professor of gynecology at the University of Pennsylvania, makes the following statement: "We prefer radiation because when carefully analyzed, the end-results of surgery are no better than if as good as those secured by radiation. In the Clark Clinic we have not submitted a case of cancer of the cervix to hysterectomy for five years, and this, despite the fact that Dr. Clark was one of the pioneers in the radical operation."

Crossen states that his general plan of treatment of cancer of the cervix is to give a heavy dose of radium and follow this with deep x-ray therapy.

Kelly says: "On account of the numerous distressing recurrences even in the hopeful group (carefully selected cases of cancer of the cervix) there is a growing inclination to decline operation in favor of radiation." This statement from a man having such a large surgical experience should carry a great deal of weight.

G. G. Ward, Woman's Hospital of New York, makes this statement: "The morbidity results of the radical operation—fistula, thrombosis, suppuration, etc.— are not to be forgotten." He believes that in the very early stages of the disease, surgery will effect as many cures as will radium, but only at the expense of high primary mortality and greater morbidity. He has not performed an operation for carcinoma of the cervix since 1920.

Lynch, of the University of California, remarks: "Surgery should be restricted rather than developed, since it is amply proved that the results of radium and x-ray in the treatment of borderline cases far surpass those of surgery, and most of the cases fall in this group."

W. J. Mayo states: "Cancer of the cervix in the earliest stages is certainly as well treated by radium as by hysterectomy, and in the advanced cases where hysterectomy is not possible, radiotherapy will occasionally yield splendid local results; even though metastatic processes later appear without local recurrence, the benefit is as lasting as could be produced by the knife."

The opinions of these eminent men cannot be disregarded and it is reasonable to say that until some better treatment is discovered, radiation therapy is the best treatment for cancer of the cervix.

ETIOLOGY AND PROPHYLAXIS

The etiology of cancer of the cervix (or of any other part of the body) is not known, and it is not within the scope of this paper to discuss the various theories that have been advanced regarding it. We can only analyze as thoroughly as possible the conditions existing in the area in which cancer has become engrafted. The established relationship between chronic irritation and cancer gives hope that better obstetric care and surgical prophylaxis in the treatment of ulcers and tears will reduce the incidence of cancer of the cervix.

In a series of 5,000 cases studied by Graves, in which cervical repair had been done, only 4 patients later developed malignancy. While these figures have not been checked with an equally large series of cases, they furnish sufficient proof that repair operations, properly performed, are a most effective prophylaxis against cancer of the cervix. However, advanced cases will continue to be seen, and greater efforts must be made to improve the present methods of treatment.

DIAGNOSIS

Pain, hemorrhage, and an odorous discharge are undoubtedly symptoms of carcinoma of the cervix, but generally of a hopeless case. Therefore, the condition must be recognized before these symptoms appear. Any deviation from the normal menstrual cycle must be investigated and any discharge must be accounted for. The simplicity of the equipment for the pelvic examination, the fact that the cervix is easily accessible for inspection, and bearing in mind the fact that any discharge is pathologic, should render the diagnosis of carcinoma of the cervix a very simple matter for every physician. In case of doubt, we feel certain that biopsy does no harm.

CLASSIFICATION

Anyone who has treated a large group of cases is at once impressed by the varied, individual differences in resistance to cervical cancer, but as Burnam points out, "Neither the nature of normal body defenses nor knowledge as to how to amplify them is at hand."

Broders developed a method of evaluation of histologic malignancy by which the prognosis of a case can be expressed on a numerical basis,

dividing the cases into four groups according to the degree of cellular differentiation, the mortality rising correspondingly to the decrease in differentiation. The one drawback to this method is that this sort of work is necessarily subject to personal equation, and is difficult to standardize, just as a certain type of operation is difficult to standardize. Direct, personal contact with Broders would be necessary in order to develop a precise duplication of his method.

Stimulated by the excellent work of Broders, a tremendous amount of investigation is being carried on for the purpose of determining whether there is any definite relationship between the histologic structure of a carcinoma and its malignancy, and to try to deduce from this finding the best form of treatment for the particular type of condition in question, and to determine the prognosis.

Martzloff has carried on investigations relating to the predominant type of cell present, and from a study of 387 cases he concludes that the histomorphology of the predominant types of cells in epidermoid cancer of the cervix is important, as it indicates the relative malignancy of a given tumor. From his study he proved that the spinal cell type of cancer is the least malignant, the transitional cell type the next in order of increasing malignancy, and the fat spindle cell type, the most malignant of all. However, we know that pathologists frequently differ as to the classification of an individual cell. Hueper objects to Martzloff's method on the ground that the evaluation of histologic malignancy based on only one factor is incomplete and incorrect. He believes that a carcinoma is not sufficiently characterized by the cell type alone; the amount of anaplasia must also be taken into consideration.

Hueper has developed a technic of evaluation of histologic malignancy based on twenty factors which are recognized as being characteristic of differentiation and anaplasia, and which are evaluated on a percentage basis. The sum of these results translated into numerical values he calls ''histologic malignancy index'' or ''histologic malignogram.'' He believes that this method is freed to a large extent from the influence of personal experience and interpretation through the introduction of well-defined standards, so that a duplication by other workers is made possible. This is an elaborate piece of work and undoubtedly will go far toward solving the problem, but again, for routine work, it probably is not practical. However, it is to be hoped that from all these investigations will come eventually a simple formula which will help the clinician to classify his cases more intelligently and thereby improve his end-results. So far we have not attempted to grade our malignant cases.

Merely the classification of the malignancy according to histologic structure does not, however, tell the story of the end-result. It is important also for the clinician to classify his cases according to the extent of the disease. A Grade 1 malignancy with wide extension would not be expected to have the same chance of cure or of palliation that a Grade 3 or 4 would have, if it were absolutely confined to the cervix.

An effort is being made to standardize the many classifications of malignancies which are in use at the present time. Some clinicians classify them merely as operable, borderline, or advanced; others divide

them into four groups and some into five groups. For working purposes, we believe that the classification into four groups made by the American College of Surgeons is quite practical, except in regard to the question as to whether or not the broad ligaments are involved. Very frequently it is impossible to decide whether the condition is inflammatory or whether it is malignant. The case of recurrent carcinoma of the cervix after hysterectomy (complete or supravaginal) should also be segregated from the primary cases.

RATIONALE AND TECHNIC OF RADIUM THERAPY

For practical purposes, the simple idea that radiation is a means of destroying cancer cells without too much injury to the normal cells is a good working hypothesis, but by reason of our accumulating knowledge of the physics of radiation, and of the biologic effects of radiation, we are being led to a better understanding of its action. In brief, radium has a threefold action on malignant tissue. It affects (1) the cancer cells (2) the connective tissue, and (3) the blood and lymph vessels. The action on the cancer cell is shown microscopically by swelling and vacuolization of the protoplasm and by shrinking of the nuclei. This is followed by phagocytosis and absorption and replacement by a homogeneous connective tissue. This contracts and affects the lymphatic and smaller blood vessels and starves the growth.

There is not sufficient time to enumerate the varieties of technic which have been used since radium therapy was instituted nor to mention all the men who have contributed to the advancement of our present knowledge. Suffice it to say that there are two entirely different schools of thought in regard to the method of treatment. In one the opinion is that it is best to give large massive doses in a short space of time, preferably in one, or at most, two sittings. The other is that it is preferable to give very small doses over a longer period of time. I believe that most of the large clinics in this country favor the former opinion, while the latter group is led by Regaud of the Radium Institute of Paris. This difference of opinion will undoubtedly be settled before many years, after the results of both methods are compared. Standardization of radium dosage for uterine cancer is impractical, dosage and technic must vary with the character and location of the involvement.

The technic followed in the Cleveland Clinic has varied very little during the past ten years, the only change being that since we have had a larger amount of radium available, we are giving larger doses over a shorter period of time, and we try to give the complete dose at one sitting, whereas previously the total amount of radiation was given in two doses. The average dose given in our earlier cases was 4200 mg. hours distributed evenly in and against the cervix. In our later cases, since we have combined radium with high voltage x-ray, the average

dose is about 3,600 mg. hours. Our standard screen is made of brass, one and one-half mm. in thickness, and this is encased in a rubber tube 3 mm. thick. At the present time we place a tube in the fundus as well as in the cervix, because in our earlier cases we found frequently that a patient would be free from symptoms for a year or so and then suddenly have bleeding and discharge, and examination would reveal a large undermined cavity at the upper end of the vagina due to the fact that the radium had not been placed high enough in the cervical canal. From this finding we are led to believe that an anesthetic is necessary in order to estimate the extent of the growth, and also to place the radium accurately in proximity to the growth. It is sometimes impossible, even when the patient is under an anesthetic, to place a tube of radium high in the cervical canal.

In addition to the radium tubes placed in the fundus and cervix, two or three tubes are placed against the cervix and these are held in place by packing the vagina tightly with gauze. If the growth is of the cauliflower variety, it is frequently curetted away or radium needles are placed in it. A catheter is then placed in the bladder to keep it empty and therefore as far away as possible from the radium. Care should be taken in transferring the patient from the table to the cart and from the cart to the bed. We believe that bending and twisting of the patient during the transfer will dislocate the vaginal tube and may account for bladder and rectal symptoms. The best method is to place the cart alongside the table and slide the patient on to the cart by a sheet, and from the cart to the bed in the same manner, so that the position of the patient is unchanged throughout the procedure. We have not used gold seeds in the treatment of any of these primary cases, but they are of great value in the treatment of recurrences, because their action is more or less localized. Large, heavily filtered doses frequently are harmful in the treatment of recurrence. We have not had any experience in placing gold seeds in the broad ligaments by laparotomy.

We have tried numerous remedies for radium sickness but none is entirely satisfactory. Many patients have no sickness even after large doses of radium. In some cases the sickness is due not to radium but to the anesthetic or to the morphine which is given for pain or discomfort.

The majority of the patients are able to leave the hospital the day following treatment unless they live some distance away. They are instructed not to be too active and to take a douche once or twice daily. They are given an appointment to return in three or four weeks for high voltage x-ray therapy which is administered by Dr. Portmann. The treatment is given in four or five doses over a period of four or five days. In 1925, we gave the x-ray treatment in two doses on the days immediately following the radium treatments, but we soon found that this method did not give satisfactory results, for statistics show

that in that year the duration of life after radium treatment was greatly reduced and the patients led a very miserable existence on account of rectal and bladder symptoms.

After patients have been treated we make an effort to have them return at monthly intervals for three months, and after that, every three months during the following year. If local recurrences develop, they are treated with seed implantation. If the recurrence is deep, x-ray therapy is repeated, with marked relief for a time. In cases in which there is no ureteral involvement, but pain is referred down the legs, we plan in the future to do a chordotomy, just as a gasserian ganglion operation is done for relief of pain in cases of extensive malignant disease of the face.

We have always taken the stand that surgery following apparent cure by radium therapy is not only unnecessary but is frequently disastrous, and many surgeons who employed this procedure from five to ten years ago have now abandoned it. Neither should radiation be relied upon to offset the disaster of an incomplete operation.

COMPLICATIONS

The chief complications in the treatment of carcinoma of the cervix by radium are hemorrhage, symptoms referable to the rectum and bladder, and fistulae (urinary and fecal).

Hemorrhage may be due to the natural progress of the disease or to ulceration caused by the radium. We believe the former is the usual cause. In the most serious cases packing and transfusion are sufficient to control the hemorrhage.

Bladder and rectal symptoms are of two types—early and late—and it is quite important that they should be recognized. It is reasonable to assume that if a sufficient dose of radium is given to cure carcinoma of the cervix, it will also be sufficient to produce an erythema to the rectum or bladder. Very often this erythema is slight and passes unnoticed unless the patient is questioned. If it is severe, it is evidenced by a slight burning sensation and a desire to go to stool or to void somewhat more frequently than usual. In the mild cases, the condition usually clears up in ten days or two weeks, but in the severe cases from four to six weeks may be required. It is in this latter group that the late rectal and bladder complications develop, usually six or eight months after the initial radiation treatment. These late symptoms are frequently mistaken for a recurrence of the carcinoma, and if the patient is treated for recurrence, irreparable damage will result. A clue to the true state of affairs is found in the fact that the symptoms are out of all proportion to the findings. There is severe pain and tenesmus and the stool contains considerable blood and mucus. Digital examination causes greater pain than in the case of recurrence. The patient is not cachectic. Proctoscopic examination reveals a puckered up scar or small ulcer at about the level of the cervix with telangiectasis and considerable

redness of the mucosa. The condition may be compared to an over-treated area on the skin which is healed by the formation of scar tissue through which fine vessels may be seen to course. In the rectum the scarring is subject to trauma and infection with subsequent ulceration which causes the late symptoms.

The same is true in the case of late bladder symptoms. Cystoscopic examination will reveal an area of intense redness and sometimes ulceration. We have observed several cases of this type over a period of months, and a few over a period of two years. Occasionally the urinary salts will be found deposited in the slough in the bladder and stones will be formed.

For the rectal symptoms the treatment consists of rest in bed, cleanliness of the lower bowel, and the injection of three or four ounces of warm olive oil into the rectum twice a day. Occasionally an opium suppository is necessary.

For the bladder symptoms we recommend rest, irrigation of the bladder, and the instillation of gomenol.

Some of these bladder and rectal complications may take from four to six months to clear up.

Fistula.—We know that the natural progression of carcinoma of the cervix will cause a certain number of fistulae into the rectum or the bladder. In some of our earlier cases fistulae may have resulted from treatment of the carcinoma, but we feel certain that with our present-day knowledge and our improved methods of treatment, the incidence of fistula will be lower than in cases in which the patient has received no treatment at all. If the fistula appears soon after treatment we interpret it as being due to destruction from the disease. If it appears late, and there is no evidence of recurrence of the carcinoma, it is probably due either to progressive ulceration or to the later complications mentioned above, and hence is the direct result of radium treatment.

The method of treatment of a fistula in the rectum must depend upon its size and the amount of inconvenience experienced by the patient. A small fistula may not require treatment. If a large fistula is present, it may be advisable to do a colostomy before attempting to repair it, and close the colostomy if and when the repair is successful.

The urinary fistula is more annoying on account of the constant flow of urine. If the fistula is small, it can easily be repaired by operation. If it is irreparable, the patient would be made more comfortable by transplantation of the ureters into the sigmoid.

END-RESULTS

The statistics reported from the United States and abroad in regard to the end-results of treatment for carcinoma of the cervix are too numerous to be published separately, but if they are combined into one group, the following results will be shown:

Five-year cures	25 per cent	
Clinical cures—three years	35 to 40 per cent	
Clinical cures—less than three years	about 50 per cent	

From the series of 325 cases here reported, 11 were pronounced hopeless and no treatment was advised. This decision would seem to have been justified by the fact that in these 11 cases the average duration of life was only six weeks. Twelve patients refused treatment or went elsewhere. Twenty-three patients had been treated elsewhere and referred back to the Clinic. Thus, we attempted to cure or palliate the disease in 97 per cent of our cases.

Below are shown in tabular form statistics of 241 cases of primary carcinoma of the cervix treated in the ten-year period from 1920 to 1929, inclusive.

YEAR	TREATED	TRACED	NO.	PER CENT	YEARS	DEAD	DURATION OF LIFE
		Living Over Five Years					
1920	8	8	2	25	9	6	11 months
1921	17	15	4	24	8	13	10½ months
1922	22	21	5	23	7	17	16 months
1923	26	23	5	20	6	21	17 months
1924	24	21	8	33	5	16	18 months
	97	88	24	25	5	73	14½ months
		Living—Three to Five Years					
1925	21	17	5	25	4	16	10 months
1926	30	25	9	30	3	21	13 months
	51	42	14	27½		37	11½ months
		Living—Less than Three Years					
1927	32	26	10	31	2	22	14 months
1928	13	10	6	46	1	7	12 months
1929	48	42	35	66	–1	13	– months
	93	78	51	54		42	

It will be seen that of 97 patients treated over five years ago 25 per cent are alive and well. Patients not traced are counted as dead. The average duration of life of patients who died was fourteen and one-half months. Fourteen, or 27½ per cent are living from three to five years, and 54 per cent are alive from one to three years following treatment.

In conclusion, it is to be hoped that eventually the disease will be recognized earlier, and this, combined with our increasing knowledge of the behavior of cancer and our improved technic of treatment, will increase our curability rate.

REFERENCES

(1) *Brooks, C. D.:* Am. J. Roentgenol. 14: 541, 542, 1925. (2) *Burnam, C. F.:* Am. J. Roentgenol. 9: 765-771, 1922. (3) *Burnam, C. F., and Neill, W., Jr.:* Radiology 5: 1-4, 1925. (4) *Crile, G. W.:* AM. J. OBST. & GYNEC. 7: 528-535, 1924. Crossen, H. S., Diseases of Women, C. V. Mosby Co., St. Louis, Mo., ed. 5, 1923, p. 626. (5) *Cullen, T. S.:* Surg. Gynec. Obst. 33: 137-144, 1921. (6) *Davis, L.:* Boston M. & S. J. 176: 660-663, 1917; ibid. 188: 304-307, 1923; Ann. Surg. 76: 395-404, 1922. (7) *Duncan, R.:* Texas State J. Med. 20: 366-370, 1922. (8) *Durham, P. E.:* M. J. & Rec. 121: 597-600, 1925. (9) *Frankel, L.:* Zentralbl.

f. Gynäk., 1926. (10) *Fricke, R. E.:* Arch. Physical Therapy 7: 189-195, 1926. (11) *Heyman, H. V. J.:* J. Obst. & Gynec. Brit. Emp. 31: 1-19, 1924. (12) *Hueper, W. C.:* Surg. Gynec. Obst. 47: 502-511, 1928; Arch. Path. 6: 1064-1097, 1928. (13) *Jones, T. E.:* AM. J. OBST. & GYNEC. 9: 662-666, 1925; Wisconsin M. J. 22: 466-469, 1924. (14) *Kelly, H. A.:* Gynecology, D. Appleton & Co., New York, 1928. (15) *Kelly, H. A., and Burnam, C. F.:* J. A. M. A. 65: 1874-1878, 1915. (16) *Lynch, F. W.:* J. A. M. A. 87: 1700-1704, 1926. (17) *Martzloff, K. H.:* Bull. Johns Hopkins Hosp. 34: 141-149, 184-195, 1923. (18) *Mayo, W. J.:* J. Med. 9: 462-470, 1928. (19) *Miller, C. J.:* New Orleans M. & S. J. 81: 253-260, 1928. (20) *Norris, C. C.:* J. A. M. A. 90: 199-201, 1928. (21) *Peterson, R.:* New York State J. Med. 20: 313, 1920. (22) *Pomeroy, L., and Strauss, A.:* J. A. M. A. 83: 1060-1062, 1924. (23) *Pomeroy, L. A.:* Am. J. Roentgenol. 18: 514-519, 1927. (24) *Ross, J. W.:* Canad. M. A. J. 12: 772-780, 1922. (25) *Schmitz, H., and Hueper, W.:* Radiology 11: 361-369, 1928. (26) *Schmitz, H., Hueper, W., and Arnold, L.:* Am. J. Roentgenol. 16: 30-42, 1926. (27) *Schmitz, H.:* AM. J. OBST. & GYNEC. 9: 644-658, 1925; Am. J. Roentgenol. 10: 219-228, 781-790, 1923; J. A. M. A. 84: 81-84, 1925. (28) *Stevens, J. T.:* Radiology 10: 57-61, 1928. (29) *Swanberg, H.:* Radiol. Rev. 51: 107-123, 1929. (30) *Vander Veer, E. A.:* Am. J. Obst. & Dis. of Women 76: 771, 1917. (31) *Ward, G. E.:* J. A. M. A. 87: 1697-1700, 1926. (32) *Ward, G. G., and Farrar, L. K. P.:* J. A. M. A. 91: 296-299, 1928.

EAST NINETY-THIRD STREET.

Jones, E. M.: Affections of the Round Ligament with a Report of a Case of Double Tuberculous Hydrocele. Minn. Med. 13: 247, 1930.

Besides an extensive review of the affections of the round ligament with special reference to tumors, the author reports a case of tuberculous hydrocele, the only case on record as far as he has been able to determine. It occurred in an eighteen-year-old unmarried girl, who had noticed swellings in the inguinal regions gradually increasing in size over a period of a year, accompanied by pain and dysuria. The masses were soft, presented at the enlarged external inguinal rings, could be easily reduced, and transmitted a slight impulse on cough. Urinary and pelvic examinations were negative. At operation the cystic masses were found to extend to the internal rings, were densely adherent to the posterior wall of the canal, but did not involve the peritoneum. They were removed and the patient made an uneventful recovery. Pathologic examination showed the specimens to be cyst-like sacs, the left multilocular, and the right unilocular, both filled with yellow, gelatinous material. The walls showed numerous miliary tubercles. There were no abnormal findings in the patient to account for the condition, even though careful and complete subsequent examinations were made. The only significant feature was a history of repeated attacks of pleurisy which in the author's opinion represents an old tuberculous infection.

FRANK SPIELMAN.

THE SEDIMENTATION RATE IN GYNECOLOGY AND OBSTETRICS*

RESULTS BY THE MODIFIED WESTERGREN TECHNIC IN OVER 2000 DETERMINATIONS ON 1100 PERSONS

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THE recent development of a rapid and convenient method for the determination of the sedimentation rate of the red cells[1] led us to make this study to discover the diagnostic value of this particular technic and to establish as a basis for comparison typical figures for the different conditions included in the fields of obstetrics and gynecology. A total of 2100 tests on 1145 persons form the basis for the conclusions here presented. Of these, 220 tests were on healthy women. The results in medicine, surgery, and the other specialties will be presented elsewhere.[1]

Since the extensive literature has been reviewed recently by Fåhreus[2] and others,[3] it will not be discussed here.

DISCUSSION OF CURRENT METHODS

A large number of methods have been devised, all of which give results of clinical value. Each, however, has at least one disadvantage. In the case of the methods that require sedimentation to a definite point, the necessity of making frequent observations is a distinct disadvantage. Methods that require sedimentation for longer than one hour are not so desirable as the short time method described in this paper. In those methods in which test tubes are used, the cleaning of the tubes is difficult. All these methods require a special dilution of the blood with anticoagulant solution which constitutes not only an extra step in the procedure, but introduces another possible source of error. We consider dilution of the blood undesirable if it can be avoided.

THE METHOD USED IN THIS WORK

A recent modification[1] of Westergren's method by H. D. Haskins, F. E. Trotman, and E. E. Osgood was chosen for this work because it eliminates the above listed disadvantages. The only pieces of appara-

tus required are pipettes* graduated from 0 to 200 mm. at the tip, and a rack† for supporting them in a vertical position.   (Figs. 1 and 2.)

The technic is as follows: Draw well-mixed oxalated venous blood up to the zero mark on the pipette, wipe the excess blood off the tip, and insert in the special rack.   Press the tip of the pipette against the rubber before releasing the finger. Note the upper level of the blood if it is not exactly at the zero mark and record
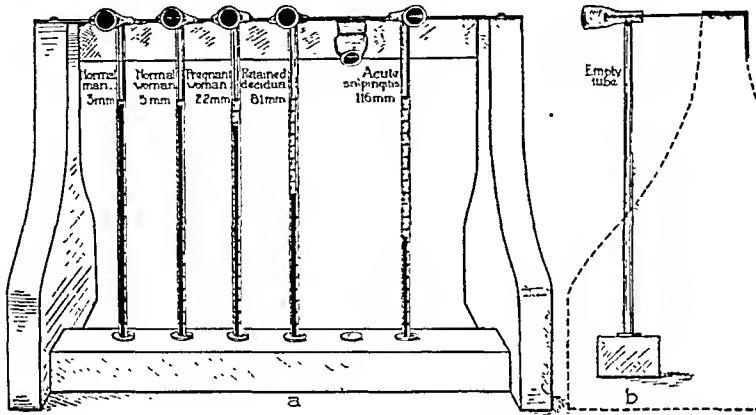
Fig. 1.—Rack with tubes in position held in place by spring and rubber piece.
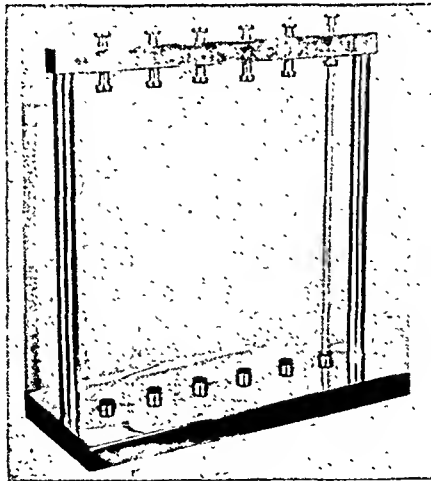
Fig. 2.—Improved rack.

the time; read the upper level of the red cells at fifteen and forty-five minutes after the start.   If the red cells do not form a sharp layer, estimate the correct level.

Since this method is one of those included in the uniform system of hematologic methods for use with oxalated venous blood,[4] recommended by E. E. Osgood, H. D. Haskins, and F. E. Trotman, it is done on the same blood sample that is used for other hematologic or blood chemistry methods.   No dilution of the blood is made.   The test tube

*Obtainable from Arthur H. Thomas Co., Philadelphia (Specification No. 1710 C).
†Obtainable from National Appliance Company, 211 Oak St., Portland, Ore.

in which the blood is collected should contain 2 mg. of powdered potassium oxalate for each 1 c.c. of blood to be drawn. The report can be ready in forty-five minutes after the blood reaches the laboratory. After it is once set up, the technician need look at it only twice; once at fifteen minutes, and once at forty-five minutes, thus saving considerable time. Only 1 c.c. of blood is required. The tubes are more easily cleaned than the ordinary 1 c.c. pipette.

METHOD OF REPORTING RESULTS

Early in this work the distance traversed by the top of the red cell column in the thirty minute interval between the fifteen and forty-five minute readings was chosen as the best indication of the true sedimentation rate, and this form of reporting the rate has been retained in this paper. Study of our completed figures reveals, however, that in certain cases, more information is gained when both the fifteen minute and forty-five minute readings are reported.
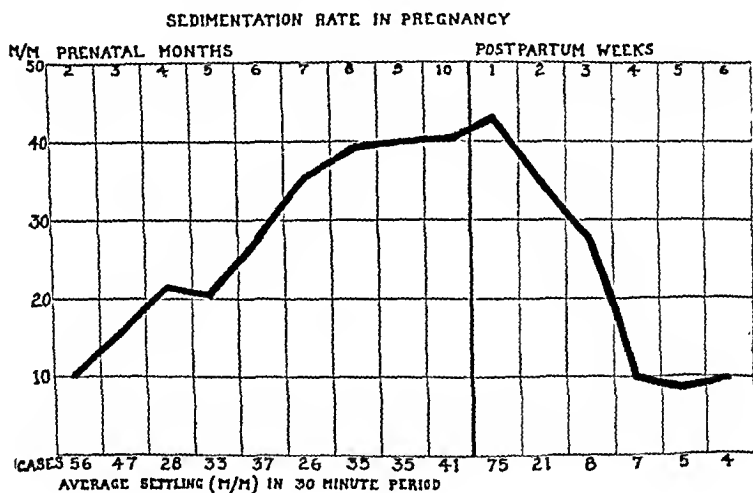
Fig. 3.

NORMAL VALUES

Studies of two hundred healthy nurses have established a rate of 10 mm. (e.g., 5 mm. in fifteen minutes and 15 mm. in forty-five minutes) as the extreme upper limit of normal. Ninety per cent showed rates of less than 7 mm. The variations between different phases of the menstrual cycle were too slight to be considered separately. A rate more rapid than 10 mm. should be interpreted as abnormal even during menstruation.

OBSTETRIC PATIENTS

The results are presented in Table I and Fig. 3. Note that unless there are other complications, the sedimentation rate in the pregnant woman remains normal until the third month, at which time an increase usually begins. From this time on, in most cases, it increases

throughout pregnancy, reaching a high point in the tenth month. In eight patients (2.7 per cent of the prenatal cases) an unaccountably slow rate persisted throughout pregnancy.

The average sedimentation rate in uncomplicated postpartum cases is somewhat higher than that of the tenth prenatal month. It then gradually decreases and in the uncomplicated case reaches normal at about the end of the fourth week. We have studied a series of thirteen postpartum cases complicated by such conditions as pelvic peritonitis, retained clots, pyelitis, thrombophlebitis, retained placenta, breast abscess, and infected perineal wounds. The average sedimentation rate in the second week in these cases was 75 mm. This gradually decreased as the patient recovered, and reached the normal in approximately the tenth to twelfth week, depending, of course, on the pathologic condition.

TABLE I. PRENATAL AND UNCOMPLICATED POSTPARTUM CASES

PRENATAL CASES			UNCOMPLICATED POSTPARTUM CASES		
MONTH	TESTS	AVERAGE 30 MINUTE READING	WEEK	TESTS	AVERAGE 30 MINUTE READING
Second	56	10.3	First	88	43.7
Third	50	14.8	Second	25	36.0
Fourth	28	21.8	Third	10	27.0
Fifth	33	21.2	Fourth	7	10.0
Sixth	38	27.3	Fifth	5	9.0
Seventh	28	34.6	Sixth	4	10.0
Eighth	37	38.4	Seventh	1	6.0
Ninth	35	39.1	Eighth	5	7.0
Tenth	45	40.5	Third month	6	9.0
			Total number of obstetric patients		305
			Total number of tests		537

GYNECOLOGIC PATIENTS

Abortion.—Sixty-two cases of abortion were examined. Of these only six cases showed a normal sedimentation rate. It has been our experience that in the absence of fever, infection, or leucocytosis ("clean" cases), the sedimentation rate returns to normal within fifteen days following curettage. We found that in cases of perimetritis, pelvic cellulitis, and pelvic abscess associated with abortions, the sedimentation rate was *most markedly increased.* We have twenty readings of over 100 mm. (forty-five minute reading). In one case of abortion complicated by epidemic parotitis, the readings were 27 mm. in fifteen minutes and 143 mm. in forty-five minutes. A considerable increase in sedimentation rate apparently occurs even in patients with simple retention of uninfected products of conception.

Tubal Pregnancy.—In each of the eight cases of ruptured tubal pregnancy studied, the sedimentation rate was definitely raised. The average of the five uncomplicated cases in the group was 22.5 mm., but in

TABLE II. SEDIMENTATION RATES IN GYNECOLOGIC CASES

NO. OF CASES	NO. OF TESTS	DIAGNOSIS	AVERAGE SETTLING (MM.) IN THIRTY MINUTE PERIOD IN THE UNCOMPLICATED CASES	REMARKS
62	146	Abortion	38.6	
8	22	Tubal pregnancy	22.5	All ruptured.
12	13	Sterility	4.5	
6	7	Asthenia	4.4	
138	530	Salpingitis	42.3	First test before treatment or operation.
4	10	Pelvic abscess	40.5	First test before treatment or operation.
39	81	Fibroid	16.0	First test before treatment or operation.
14	27	Malignancy	35.6	First test before treatment or operation.
55	56	Cervical erosions	7.0	
17	36	Ovarian cysts	11.0	
(16)		Ovarian cysts	5.0	Exclusive of case of chocolate cyst.
40	43	Trichomonas vag. vaginitis	8.0	
23	33	Infection of Skene's or Bartholin's Glands	22.0	
13	13	Froehlich's syndrome	Normal	
12	12	Endometrium hyperplasia	15.9	
80	186	Cystocele, rectocele, retroversion, and prolapse	Normal	Practically normal in most uncomplicated cases.
96	120	Miscellaneous	Varying	
619	1335			

no case was the sedimentation rate as high as is usually found in acute or subacute salpingitis. Unruptured ectopic pregnancy would doubtless give still lower rates.

Sterility.—Twelve cases of sterility showed only one case in which the sedimentation rate was increased and that was complicated by bleeding uterine myomas.

Asthenia.—Six cases were classified as asthenia, all of these having very low sedimentation rates, the average for the six being only 4 mm.

Salpingitis.—There were 138 patients with salpingitis on whom 529 tests were done. The average rate at the first examination was 42.3 mm. We have found that the sedimentation rate is usually increased in salpingitis, both acute and subacute, and in pelvic cellulitis and pelvic abscess. Notwithstanding the average increase there are too many normal or low rates to give this test much weight in the differential diagnosis between salpingitis and ectopic pregnancy. It does have

great value, however, as an aid in determining the progress of the individual case. This is best shown graphically (Fig. 4). Note the great decrease in rate in each group in cases under medical management alone, prior to operation.

It has been our custom for some time in cases of salpingitis to use the sedimentation rate test as the criterion for time of operation, i.e., we are convinced that the operation for salpingitis does not give the maximum good results and safety to the patient unless it be done when the sedimentation rate has reached normal. We feel that in salpingitis

SALPINGITIS
AVERAGE SEDIMENTATION (1st 15 MINS.) BY GROUPS OF
CASES BEFORE & AFTER MEDICAL TREATMENT. (BEFORE OPERATION)
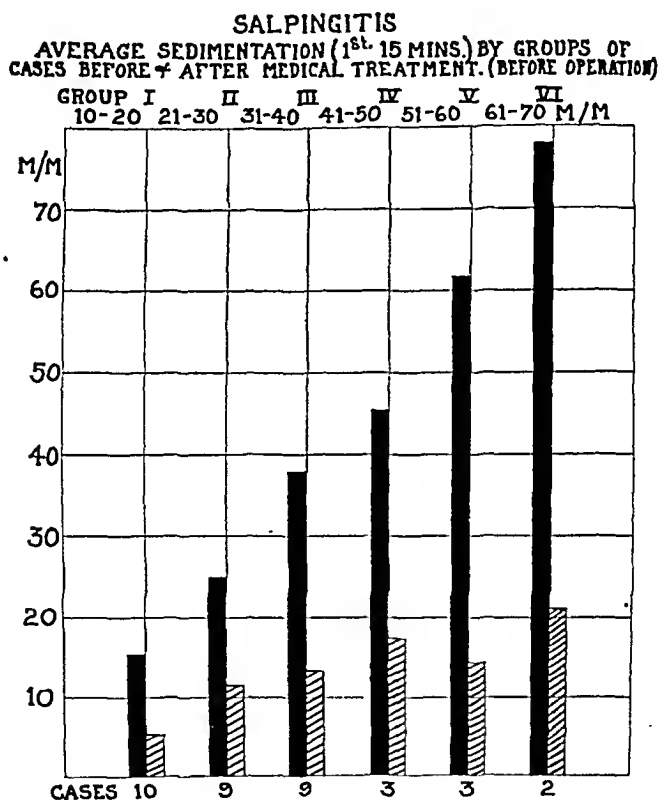
Fig. 4.

this test is definitely more sensitive than the temperature record or the leucocyte count in determining when the infection has become "cold." By this means, our mortality rate has been reduced, our postoperative hospital days have been cut down, and practically all of our patients are operated upon without drainage.

Uterine Myomas.—From the thirty-nine cases of uterine fibroids studied, we have reached the conclusion that uncomplicated uterine fibroids do not materially alter the sedimentation rate. On the other hand, degenerating tumors and those complicated by endometrial disease or polyps and those in which submucous myomas are causing bleeding, increase the rate as far as our experience has gone.

Malignancy of Ovary or Uterus.—There were 14 cases with an average of 35.6 mm. Except in a case of small recurrent papilloma of the cervix, the rates were all markedly increased, a fact which gives the test definite value in the differentiation between such a condition and an erosion of the cervix.

Cervical Erosion.—There were 55 cases classed as cervical erosion in the series. Among the complications observed which increased the rate were syphilis, hyperplasia of the endometrium, anemia, and infected tonsils or teeth. In the uncomplicated cases, the rate was normal.

Ovarian Cysts.—There were 17 cases of ovarian cysts in the series. Simple, uncomplicated ovarian cysts appear not to alter the sedimentation rate. One case of chocolate cyst of the ovaries gave a reading of 12 mm. in fifteen minutes and 56 mm. in forty-five minutes, and at operation no other complication was found.

Trichomonas Vaginalis Vaginitis.—There were 40 cases in this group. The rates in the uncomplicated cases were practically always normal. There was one case in which vaginitis was extremely severe and in which the sedimentation rate was 8 mm. in fifteen minutes and 39 mm. in forty-five minutes. There were 11 other cases with rates above normal. These were complicated by pyelitis, abortion, osteomyelitis, uterine fibroids, acute appendicitis, pelvic cellulitis, infection of Skene's glands, and ischiorectal abscess.

Infection of Skene's or Bartholin's Glands.—There were 23 cases examined. Here the sedimentation rate was always increased, striking an average of approximately 22 mm.

Froehlich's Syndrome.—Thirteen such cases were studied. Of these the sedimentation rates were within normal limits with the exception of three cases, one complicated by syphilis and two with acute respiratory infections.

Cystocele, Rectocele, Retroversion and Prolapse of the Uterus.—We examined 80 patients in this group. These conditions, when uncomplicated, do not increase the sedimentation rate. Such complications as arthritis, severely infected tonsils, pregnancy, and severe endocervicitis tend to raise the rate above normal.

Miscellaneous Cases.—There were 96 cases coming under this heading. Obviously these conditions were variable. These tests were made in the routine examination of the patients and were indeed very helpful in making diagnoses. Whenever the sedimentation rate was increased, a condition was usually found to account for it. Among such conditions can be mentioned adenitis, syphilis, chancroid, cholecystitis, anal fistula, rectal abscess, hyperplasia of the endometrium, infected wounds, and hematomas.

Postoperative Effects.—The sedimentation test has been frequently used by us postoperatively. We have learned that the sedimentation

rate is increased during the healing process of the wound[5] and that under normal conditions it gradually decreases. When this fall in the sedimentation rate does not occur, or if there is a rise, we search for and expect to find some complication, such as wound infection or an abscess or hematoma. Hence, routine postoperative sedimentation tests at frequent intervals are desirable.

COMMENT

In general, it may be said that the rate is increased after the third month of pregnancy until the fourth week postpartum, and in conditions associated with infection, internal hemorrhage, or necrosis of tissue, and that the increase in rate is roughly proportional to the extent and severity of the process. We have found that the injection of foreign protein also increases the rate. There are, however, so many causes of an increased rate and enough exceptions to the above rule, that it must be used with caution and without neglecting other available evidence in differential diagnosis. It has great value in following the course of the individual case, particularly in salpingitis. In the routine examination of a patient, the detection of a rate greater than is expected from the other clinical findings calls for further study of the case. This constitutes one of the greatest advantages of the test to the clinician. The ease with which such clues are obtained make the test rank with the clinical thermometer as an aid to accurate diagnosis.

SUMMARY AND CONCLUSIONS

The technic is given for an accurate test permitting a report on the sedimentation rate within forty-five minutes after the blood reaches the laboratory.

This test has distinct advantages over other methods of determining the sedimentation rate for the patient, physician, and technician.

Results of a large series of studies in normal women and in gynecologic and obstetric conditions are presented.

Its chief value is as a clue to the existence of previously unsuspected infection or malignancy and in following the course of the individual case.

Repeated determinations on the same individual are essential if the maximum information is to be obtained.*

REFERENCES

(1) *Haskins, H. D., Trotman, F. E., Osgood, E. E., and Mathieu, A.:* J. Lab. & Clin. Med., February, 1931. (2) *Fåhreus, R.:* Physiol. Rev. 9: 241, 1929. (3) *Bland, P. B., Goldstein, L., and First, A.:* Surg. Gynec. Obst. 50: 429-434, 1930. (4) *Osgood, E. E., Haskins, H. D., and Trotman, F. E.:* J. Lab. & Clin. Med., February, 1931. (5) *Mathieu, A.:* Med. Sentinel 37: 693-696. 1929.

545 MEDICAL ARTS BUILDING.

OBSERVATIONS ON THE FUNCTIONAL MENSTRUAL DISTURBANCES OF ADOLESCENTS

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(From the Department of Obstetrics and Gynecology, State University of Iowa)

IN GROPING for added light on the menstrual disturbances of adolescents, we have studied the basal metabolic rate and the uterine curettings, as well as the size of the sella turcica, as revealed by the roentgen ray, and the physical proportions, as determined by Berkow's formulas. In the latter two instances, it was necessary to run large series of controls to establish normals, so that this is merely a preliminary communication dealing with our limited findings.

THE BASAL METABOLIC RATE

It is well established that marked variations in thyroid gland function, as shown by the basal metabolic rate, may have a profound effect upon the menstrual function, but it is not generally realized that minor variations may likewise apparently be significant. There is a tendency to minimize the importance of rates between –10 and –20 per cent, and to discount almost entirely those between zero and minus ten, although our experience would indicate that they are more frequent in adolescent menstrual disturbances than are larger variations. With both amenorrhea and menorrhagia associated with such changes, we have been unable to determine a quantitative difference, both conditions occurring with rates only slightly depressed or down to –30 or –40 per cent. One-third of the menorrhagia group showed rates as low as –15, while one-half of the amenorrheics reached this level. In certain instances, menstrual abnormalities occurred with normal rates, although the clinical history suggested hypothyroidism, and we are not averse to making such a diagnosis in the absence of laboratory confirmation.

The therapeutic results obtained with the cautious use of thyroid extract, especially in menorrhagia, are so good as to suggest the advisability of administering the drug to such patients even when the basal metabolic rate is not particularly low. In amenorrhea the effect is not so readily obtained, although occasional satisfactory results are secured. While in menorrhagia it is commonly possible to control the excessive bleeding within a few days by the employment of thyroid extract, intermittent treatment over a period of months may be needed, since there is a tendency for the profuse flow to recur when the extract is not taken. We have several girls between the ages of fifteen and eighteen years to whom intermittent medication is being given in the hope that gradually a readjustment will occur to render it unnecessary.

THE ENDOMETRIUM

Even in the absence of demonstrable pelvic disease, we have frequently curetted those young women who complain of excessive flow, and have convinced ourselves that the endometrium is normal histologically or shows a hyperplasia, which is not readily explained. The therapeutic value of the procedure is limited and temporary, but in persistent cases the knowledge that a serious lesion is not being overlooked is consoling.

In amenorrhea the curette is not employed, since its therapeutic use is scarcely justified, and there is always the danger of removing an early gestation. With our present knowledge that the pelvic organs are dependent upon distant glands for stimulation and development, local irritation of the uterus hardly seems reasonable.

Table I presents the basal metabolic rates and the histologic diagnoses in certain typical cases.

TABLE I. BASAL METABOLIC RATES AND HISTOLOGIC EXAMINATIONS OF THE UTERINE MUCOSA IN TYPICAL CASES OF MENORRHAGIA AND SECONDARY AMENORRHEA

HOSPITAL NUMBER	AGE	COMPLAINT	BASAL METABOLIC RATE		PATHOLOGIC DIAGNOSIS
			BEFORE THYROID	AFTER THYROID	
GIRLS UNDER 20 YEARS OF AGE					
B- 2725	15	Menorrhagia	−15.0	+11.0	Normal endometrium.
A- 2534	15	Menorrhagia	−22.8	+ 3.0	—
D- 1199	17	Menorrhagia	−21.2	+ 5.2	Normal endometrium.
C- 8387	18	Menorrhagia	− 7.3	+12.8	Normal endometrium.
C- 265	17	Menorrhagia	−18.3	+ 4.0	Hyperplasia of endometrium.
E- 4641	16	Menorrhagia	+14.3	None given	—
D- 6548	19	Menorrhagia	− 4.3	—	Normal endometrium.
B-10971	15	Menorrhagia	−22.5	− 8.1	—
E- 5219	19	Menorrhagia	− 8.4	—	Hyperplasia of endometrium.
E- 2038	16	Amenorrhea	− 7.7	—	—
E- 2309	17	Amenorrhea	−43.0	− 5.6	—
D- 4037	17	Amenorrhea	−16.5	+ 2.1	—
WOMEN OVER 20 YEARS OF AGE					
C- 8283	21	Menorrhagia	−10.5	− 1.8	Normal endometrium.
E- 5393	22	Menorrhagia	− 9.7	—	Normal endometrium.
C- 7658	24	Menorrhagia	− 7.2	—	Normal endometrium.
B- 9251	24	Menorrhagia	−12.4	—	Normal endometrium.
D- 5271	24	Menorrhagia	− 8.0	—	Hyperplasia of endometrium.
D- 4737	22	Menorrhagia	+13.2	—	Hyperplasia of endometrium.
A- 411	22	Menorrhagia	−15.6	+19.1	Hyperplasia of endometrium.
D- 1242	24	Menorrhagia	−10.8	+ 5.9	—
A- 4325	21	Menorrhagia	−25.6	+ 2.9	—
C- 8610	24	Amenorrhea	−18.9	+ 4.8	—
E- 1521	24	Amenorrhea	−25.5	−15.3	—
D- 2757	24	Amenorrhea	−15.4	—	—

THE SIZE OF THE SELLA TURCICA

Recognizing the validity of the recent declaration that the hypophysis is "the motor of the ovary," and suspecting that in adolescents size might well be related to function, and that the size of the sella, as

shown by uniform x-ray films, should vary with the size of the enclosed pituitary gland, attention was directed to the possibility that demonstrable variations might occur with menstrual anomalies.

Control material was provided by a group of young girls between eleven and eighteen years of age, who had no complaints but were examined in the course of a health contest, and by a smaller group of nurses who volunteered. None of these individuals had pelvic or menstrual complaints, other than mild dysmenorrhea, and the majority were subjected to a rectal examination to determine the absence of gross pelvic lesions. Among 90 such individuals, all but six had sellas measuring between 8 and 12 mm. in the greatest diameter. (Fig. 1.) None of the three with sellas under 8 mm. had menstruated, although

SMALL SELLAS
No. 36 – 6 mm. 14 yrs. 4 mos. No menses.
No. 54 – 6 mm. 14 yrs. 7 mos No menses.
No. 76 – 7 mm. 11 yrs. 6 mos. No menses.

Fig. 1.—Diameter of the sella turcicas in the control group.

two were fourteen years four months and fourteen years seven months of age, respectively, at the time of the examination. These latter girls were underdeveloped and resembled younger children in their general body proportions.

On the other hand, of the three girls with sellas 13 millimeters in diameter and presenting normal menstrual histories, only one showed normal physical development, the other two being unusually large; one, a girl of thirteen years, being 5 feet 2¼ inches tall and weighing 152 pounds, while the other, a nineteen-year-old nurse, was 5 feet 8½ inches tall and weighed 182 pounds.

When the age of onset of menstruation in this control group is plotted against the size of the sella in millimeters (Fig. 2), a slight retardation is apparent in those with small as well as in those with

larger sellas (12 and 13 mm. in diameter). Perhaps some of these variations will disappear when a larger group is studied, as is planned for this year.

Twenty-one girls in the control group had not yet menstruated, of whom six had passed their fourteenth birthday. In two, the sella was 6 mm., in one 9 mm., and in three 10 mm. in diameter. Only one was normally developed, the others showing delayed appearance of the secondary sex characters and boyish figures. (Fig. 3.)
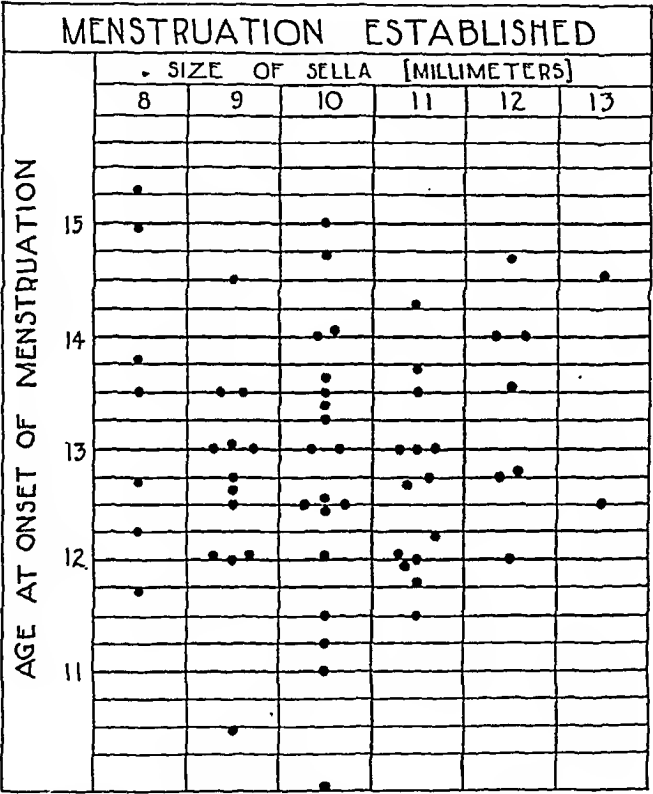
Fig. 2.—The age at onset of menstruation plotted against the size of the sella.

Among 13 young women with menorrhagia or metrorrhagia without established pelvic basis, there was only one who showed a sella less than 10 mm. in diameter, and her history placed her essentially as an amenorrheic with recently appearing menorrhagia. On the other hand, the five patients with secondary amenorrhea (no primary amenorrheas have been encountered since this study was begun) presented generally small sellas, only one being more than 10 mm. in diameter. In this latter instance, the amenorrhea developed after the girl entered the nurses' training school, following a relatively normal menstrual course beginning at the age of eleven years. These data are presented graphically in Fig. 4.

PHYSICAL PROPORTIONS

Physical characteristics have been studied through front and profile photographs, and by the various measurements of Berkow, through which surface area computations have been made according to his formulas. Well over a hundred individuals were studied as controls, the results indicating that, as the weight increases, the proportionate surface area of the head, hands, and feet diminishes while that of the trunk and thighs increases, and the arms and legs remain practically constant. Because of this variation depending upon weight, it has been

MENSES   NOT ESTABLISHED

SIZE OF SELLA [MILLIMETERS]

Chart — AGE AT EXAMINATION (vertical, 11–15) plotted against SIZE OF SELLA in millimeters (6–12).

    1 –Height 5ft. 3¼ inches – Weight 100½ lbs
    2 –Height 5ft. 2½ inches – Weight 101¾ lbs
    3 –Height 5ft. 1¾ inches – Weight 100½ lbs
    4 –Height 5ft. – inches – Weight 66½ lbs
    5 –Height 5ft. ¼ inch   – Weight 119¼ lbs
    6 –Height 4ft. 11¾ inches – Weight 70½ lbs – Congenital Heart

Fig. 3.—The size of the sella plotted against the age of 21 girls who had not yet menstruated.

difficult to obtain sufficient controls in all groups to establish significant averages, while among the pathologic cases the figures are altogether too scant to warrant discussion, except to intimate that so far no relationship has been demonstrated. Markedly pathologic conditions of the endocrine system produce changes in body configuration which may be almost pathognomonic, but in the patients here discussed the deviations from normal were slight and probably insignificant.

In these young women, the association of obesity with the menstrual disorders accompanied by lowered basal metabolic rates was not ap-

parent. There were only two in the pathologic group who were markedly overweight. They complained of menorrhagia and presented basal rates near normal, whereas there were six obese girls in the control group without menstrual abnormalities.

DISCUSSION

The data on basal metabolic rate determinations and on the histology of the endometrium in functional menstrual disturbances merely confirm what has already been pointed out. The fact that slight variations in metabolism may be associated with the menstrual anomalies o.
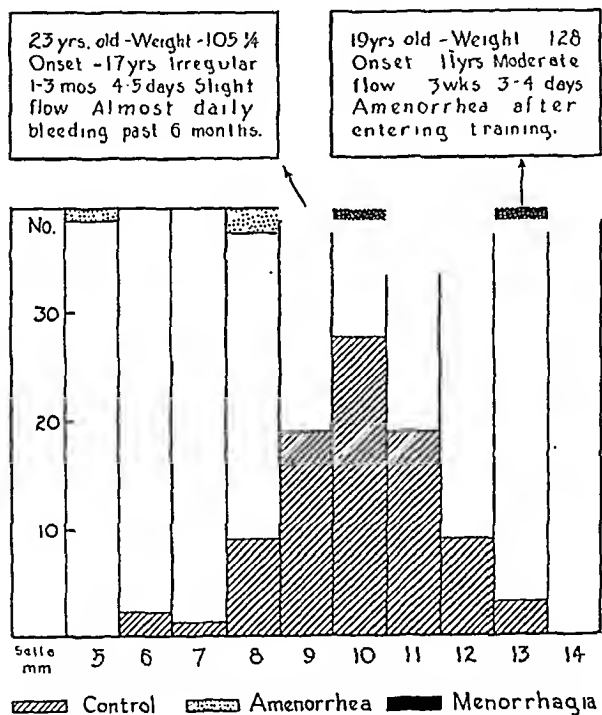
Fig. 4.—The size of the sellas in representative cases of menorrhagia and amenorrhea.

adolescence is stressed. The therapeutic administration of thyroid extract frequently controls menorrhagia, but is less effective in relieving amenorrhea.

The evidence produced to show that the size of the sella turcica in adolescent girls is related to the activity of the pelvic organs as shown by the menstrual function is suggestive but not conclusive. Should further work demonstrate that such a relationship actually exists, it should be possible to effect a better differentiation between various functional disorders than is now possible.

It should be emphasized again that this study is incomplete and that no final conclusions are permissible.

HEMORRHAGE IN THE EARLY MONTHS OF PREGNANCY

By W. B. Hendry, Toronto, Canada

HEMORRHAGE is one of the most common complications of the early months of pregnancy and, when present, it is usually significant of abortion, extrauterine pregnancy, or vesicular mole. More rarely it is a sign of cervical erosion, cervical polypus, or carcinoma of the cervix. It may also be the result of injury or tissue destruction through the application of mechanical or medicinal agents used for the purpose of terminating the pregnancy.

Then, too, there has been up until the present time a more or less widespread belief in the possibility of normal menstruation occurring during the first few months and even throughout the whole of the pregnancy. However, the modern conception of the physiology of reproduction and its relation to the menstrual cycle has done much to dissipate this belief. Biochemists throughout Europe and America have established beyond doubt the existence of two distinct hormones in the ovary; one from the whole ovary which prepares the uterine field for the reception of the ovum, and the other which is found after ovulation in the lutein tissue, which maintains the integrity of the bed in which the fertilized ovum is to lie. They have further established the fact of two hormones in the anterior pituitary body which lend a selective assistance to the two ovarian hormones in carrying out their work of preparation. Whenever an ovum escapes fertilization, the lutein hormone rapidly becomes exhausted and loses its control of the uterine mucosa; the endometrial bed breaks down and menstruation follows. When fertilization occurs and nidation commences, the lutein hormone takes on an increased activity, possibly as the result of stimulation from a trophoblastic hormone acting on it directly or through the agency of the anterior pituitary body. Consequently, the decidual bed in which the ovum lies remains undisturbed and menstruation does not take place. Accordingly, when uterine hemorrhage occurs in the presence of the known existence of pregnancy, it is logical to assume that there has been some interruption along the endocrine lines of communication, and that the resulting condition is one of threatened abortion and should be treated as such.

Of 610 cases of abortion admitted to the Toronto General Hospital during the last five years, an analysis showed that by far the largest number were self-induced by either mechanical or medicinal agents. Other causative factors were found present in the following order of

frequency: retroversion, syphilis, toxemia, subacute salpingitis, decidual endometritis, uterine myomas, pulmonary tuberculosis, deep cervical lacerations, and lobar pneumonia. Resulting complications were uterine infection, secondary anemia, pelvic inflammation with and without abscess formation, general peritonitis, septicemia, bronchopneumonia, subphrenic abscess, phlebitis, and pyometra. Complications present were cervical erosion, chronic endocervicitis, cardiac lesions, carcinoma of the cervix, acute cystitis, acute gonorrheal urethritis, several gastrointestinal lesions, colloid goiter, ventral hernia, and ovarian cyst.

CASES OF ABORTION ADMITTED TO TORONTO GENERAL HOSPITAL FROM JAN. 1, 1925 TO DEC. 31, 1929. TOTAL NUMBER 610

CAUSATIVE FACTORS	NO.	RESULTING COMPLICATIONS	NO.	OTHER COMPLICATIONS	NO.
Selfinduction	90	Uterine infection	57	Cervical erosion	21
Retroversion	48	Secondary anemia	40	Chronic exocervicitis	10
Syphilis	10	Pelvic inflammation	21	Cardiac lesions	10
Decidual endometritis	5	General peritonitis	3	Carcinoma of cervix	3
Subacute salpingitis	5	General septicemia	5	Acute cystitis	2
Toxemias	5	Bronchopneumonia	4	Acute gonorrheal	
Uterine myomas	4	Subphrenic abscess	1	urethritis	2
Deep cervical tear	2	Phlebitis	1	Gastrointestinal lesion	4
Pulmonary tuberculosis	2	Pyometra	1	Colloid goiter	1
Lobar pneumonia	1			Ventral hernia	1
				Ovarian cyst	1

The onset was gradual in about five-sixths of the cases and sudden in the remaining sixth. Hemorrhage was present in all cases and was the only symptom in 115 cases. It was followed by pain in 335 cases and was preceded by pain in 160. It was variously described as slight, intermittent or continuous, moderate or profuse, the amount varying in different cases and in the same case from slight to profuse, while in one-half of the cases it was accompanied by clots or clots and tissue. Except in the presence of infection the degree of collapse was in proportion to the amount and rapidity of the blood loss.

There was no record of pain in 115 cases. When present, it was almost invariably described as intermittent, cramp-like, varying in

CASES OF ABORTIONS ADMITTED TO TORONTO GENERAL HOSPITAL FROM JAN. 1, 1925 TO DEC. 31, 1929. TOTAL NUMBER 610

DIAGNOSIS	NO.	ONSET		RESULT		IMPROVED OR CURED	DIED
		SUDDEN	GRADUAL	SUBSIDED	ABORTED		
Threatened	68	14	54	57	11	68	—
Inevitable	35	3	32	—	35	35	—
Incomplete	385	65	320	—	—	379	5
Complete	120	31	89	—	—	115	4
Missed	2	1	1	—	—	2	—

Of these there were infected 97, with 5 cases of general septicemia and 21 cases gave a positive cervical smear of the hemolytic streptococcus.

intensity from slight to severe, and situated in the lower abdomen, being referred to the right lower quadrant in 5 cases and to the back in 3.

The majority of the cases admitted were classified as incomplete abortions, 385 coming under this head, 120 were complete, 68 threatened, 35 inevitable, and 2 missed abortions.

Of these cases 97 were found infected at admission, 5 having a general infection with positive blood cultures of hemolytic streptococci, and 21 giving a positive smear of the same organism obtained from the cervix.

The treatment varied with the condition of the patient on admission. For cases of threatened abortion our treatment in every case consisted of absolute rest in bed and sedatives as necessary to control pain, nervousness, or restlessness. Certain schools, principally European, advocate the use of strychnine and ergot where there is bleeding without uterine contraction, on the grounds that ergot will not start uterine contractions where they are not already established, and will tend to stop hemorrhage by increasing the uterine tonicity. Our difficulty is to determine where uterine contractions exist, for they may be present in the absence of pain, and thus far we have been content to wait and see, rather than to give any medication which might hasten the detachment of an already unstable ovum. Out of 68 cases of threatened abortion 57 subsided under this treatment while 11 aborted.

Where the abortion was considered inevitable or incomplete, our object has been to complete it by the safest and easiest means at our disposal. This we have done by one of three methods: ergot and quinine, packing the cervix and vagina with iodoform gauze for twenty-four hours, and dilatation and curettage. The first method, ergot and quinine, we used in cases of infection, or when the ovum or part of it was through the internal os; the second method, packing the cervix or vagina, where it was necessary to control hemorrhage, and also in conjunction with the first; the third method in all other cases. We do not curette an infected uterus except in cases of severe hemorrhage or where the uterine drainage is blocked by retained secundines.

In all cases where a curettage is decided upon we prefer the sharp curette rather than either the educated finger or the dull curette. In our opinion there is more damage done, first in dilating the cervix sufficiently to admit the finger, and second, in manipulating the uterus with the abdominal hand so as to enable the finger to reach every portion of the interior of the uterus, than can be done by the judicious use of the sharp curette. Then, too, with either the gloved finger or the dull curette one cannot be certain that all the retained secundines have been removed. In our opinion it is much safer and more effec-

tive to use the sharp curette carefully and then swab out the uterus with gauze soaked in either mercurochrome or tincture of iodine, and to pack the uterus lightly with gauze for twenty-four hours.

It has been our practice to treat all infected cases conservatively, while at the same time providing efficient drainage for localized pus. In cases of hemolytic streptococcic infection we have been using scarlet fever antitoxin intramuscularly where a positive smear has been obtained from the cervix, and intravenously where the infection has become general, supplementing it with blood transfusions in the latter cases. The results have been encouraging. We feel, however, that to effect a cure the antitoxin must be given early in the course of the disease. Three of the 5 patients with general septicemia, and a positive blood culture, died, but they had been infected three weeks previous to admission to hospital and did not respond to treatment. The other two were admitted within a few days following their infection and recovered. Of 16 cases with positive smears from the cervix all made an uninterrupted recovery.

CASES OF ECTOPIC GESTATION ADMITTED TO TORONTO GENERAL HOSPITAL FROM JAN. 1, 1925 TO DEC. 31, 1929. NUMBER OF CASES 69

Age from 19-42		Onset, sudden	21	Character of pain, none	3
Average age 30		Onset, gradual to sudden	27	slight crampy	20
Previous abortions	25	Onset, gradual through-		severe	39
(1-8)		out	18	Location, lower abdomen	15
Parity,—0 para	15	Symptoms, pain before		R.L.Q.	26
1 para	26	bleeding	38	L.L.Q.	23
2 para	12	Symptoms, bleeding be-		Rectum	1
3 para	4	fore pain	13	Upper abdomen	1
4 plus para	12	Symptoms, pain without		Bleeding, amount, none	15
Amenorrhea none	18	bleeding	15	slight	33
1 month	38	Symptoms, bleeding		moderate	16
2 months	12	without pain	3	profuse	5
3 months	1	Faintness and collapse		Color, dark brown	27
		with accompanying		unclassified	27
		pain	25	clots	6
		Nausea and vomiting			
		with accompanying			
		pain	20		

With regard to ectopic gestation there were 69 cases admitted to the hospital in the last five years, the youngest being nineteen and the oldest forty-two years of age, with an average age slightly over thirty. Fifteen were nulliparous, 26 primiparous and 28 multiparous while 25 had had from one to six abortions. Eighteen had not missed a period; 42 had missed one; 8 had missed two and 1 had missed three periods. In 11 the number of periods missed was not stated. The onset was sudden in 21, gradual in 18, and gradually approaching a sudden attack in 27. It started with hemorrhage in 13 and with pain in 53. Fifteen had no vaginal bleeding before admission to hospital. Thirty-nine gave a history of slight to moderate bleeding, continuous or intermittent for periods varying from a few hours to seven

weeks, while 5 had profuse intermittent bleeding for a few days before admission. In 27 cases the blood was described as dark brownish in color, while it was unclassified in the remaining 27. In no case was there any evidence of a decidual cast.

There was no pain in 3 cases, slight and crampy in 20, sharp and severe in 39, dull aching in 7. In 15 cases it was referred to the lower abdomen; in 26 to the right lower quadrant; in 23 to the left lower quadrant; to the rectum in one and to the upper abdomen in one. Painful defecation was noted in 2 cases and in 2 there was painful and difficult urination. Nausea and vomiting accompanied the pain in 20 cases while in 25 there were fainting and collapse to a degree out of all proportion to the amount of the external hemorrhage.

CASES OF ECTOPIC GESTATION ADMITTED TO TORONTO GENERAL HOSPITAL FROM JAN. 1, 1925 TO DEC. 31, 1929. NUMBER OF CASES 69—DIAGNOSIS CHANGED IN 3

Operative Findings, Complications and Special Treatment

Type,	Unruptured	27	Complications		
	Ruptured	35	Causative,	Pelvic inflammation	5
	Tubal abortions	3		Uterine myoma	1
	Intraligamatous hematoma	1		Ovarian cyst	3
	Abdominal pregnancy	1	Other,	Secondary anemia	20
	Unclassified	1		Retroversion	1
Situation,	Rt. ampulla	30		Ventral hernia	1
	Lt. ampulla	26		B. Coli infection	1
	Rt. isthmus	2	Treatment,	Abdominal section	66
	Lt. isthmus	1		Autotransfusion	13
	Rt. tubal abortion	2		Direct transfusion	5
	Lt. tubal abortion	1		Indirect transfusion	3
	Rt. fimbria	1	Result,	Recovered	62
	Unclassified	3		Died	4

There were 27 unruptured tubal pregnancies. Thirty-five had ruptured intraperitoneally and 1 extraperitoneally, while there were 3 tubal abortions, 1 abdominal pregnancy and 3 cases in which the diagnosis was unconfirmed. Twenty-six were situated in the left and 30 in the right ampulla; 1 in the left and 2 in the right isthmus; 1 intraligamentous on the left side; 1 left and 2 right tubal abortions, while the abdominal pregnancy was attached to the fimbriated extremity of the right tube.

A comparison of these statistics with those for abortions shows that in 20 per cent of all cases considered, the signs and symptoms regarding the character of onset, type and amount of hemorrhage, and the description, severity, and location of pain were almost identical. It will be seen, then, that in many cases a differential diagnosis between these two conditions is extremely difficult. As a rule, however, abortion is more frequently gradual in its onset and ushered in by uterine hemorrhage which is usually more profuse, dark red in color, and accompanied by the passage of clots, while it is followed by pain which is moderate in severity, cramp-like in character, and definitely referred to the midline of the lower abdomen. Ectopic gestation, on the

other hand, is more frequently sudden in its onset, commencing with pain which is sharp and severe and referred to one or other side of the abdominal region, while it is followed by uterine hemorrhage which is usually small in amount and often dark brown in color. In abortion collapse is not marked, and is usually in proportion to the amount and rapidity of the blood loss, while in ectopic gestation the collapse is out of all proportion to the amount of visible hemorrhage.

A bimanual examination does much toward clearing up the diagnosis, except when old pelvic inflammatory lesions are present. When in doubt, an examination under anesthesia is advisable, at which time a posterior colpotomy may disclose blood in the pouch of Douglas, and a quick section of endometrial tissue may show the presence of decidual cells with or without chorionic villi.

When the diagnosis of ectopic gestation is confirmed, the only line of treatment to follow is operative. The abdomen should be opened, the bleeding point secured, and both the gestation sac and tube involved should be removed.

During the past few years whenever we have found a quantity of free blood in the abdominal cavity, it has been our custom to strain this blood through sterile gauze and return it to the circulation intravenously in a normal saline solution. In the present series autotransfusion was carried out in 13 cases, and proved of value in lessening the anemia and shortening the convalescence.

Of the abortions admitted there were 11 deaths, giving a mortality percentage of 1.98.

With regard to vesicular mole, this condition is rare in our experience. During the last ten years only 11 cases were admitted to the hospital wards, 3 of which were private patients. Of 8 cases in which the records were complete, hemorrhage was present in each one. It was described as scant, slight or moderate, and irregular in 4, and moderate and continuous or profuse with clots in the remaining 4. The characteristic vesicles—"white currants in red currant jelly"—were found before operation in only 2 cases.

Dull crampy pain in the lower abdomen was described in only 1 case, while in the remaining 7 there was no associated pain. Nausea and vomiting were severe in 4 and absent in 4 cases. The striking feature about this condition was that the severity of the nausea and vomiting was inversely proportional to the amount of the hemorrhage. When the hemorrhage was from moderate to profuse with the passage of clots, the nausea and vomiting were absent, and when the hemorrhage was slight, the nausea and vomiting were severe and resistant to intensive treatment.

Two of these patients had missed one period, 4 had missed two and 2 had missed three, but in each case the size of the uterus was described as that of a four to five months' pregnancy.

All of these patients were operated upon, 6 by means of a careful dilatation and curettage. In the seventh an abdominal hysterectomy was done, owing to the presence of a large fibroid. This patient died three days later from pulmonary embolism.

In the last case I was tempted to do an abdominal section, more through fear of being unable to clear out the uterus completely from below than for any other reason, and found that the clearing out of all vesicles was much more quickly and satisfactorily done than from below. However, I am not prepared to advocate this method as a routine treatment.

Postoperative observation is absolutely necessary in all cases of vesicular mole, on account of the danger of choriocarcinoma. Three members of this series were curetted within six weeks after discharge from the hospital and in two a few vesicles were recovered. All patients were kept under observation for a year and showed no further signs of trouble.

Concerning the remaining conditions which may give rise to hemorrhage in the early months of pregnancy, one may lay down the principle that all cases should be investigated in order to determine the lesion which is responsible for the bleeding. Where it is due to erosion of the cervix, the small electrocautery may be used with discretion, care being taken not to approach the internal os. Cervical polypi may be snared off and hemorrhage controlled by cauterization, but where carcinoma of the cervix is present, a therapeutic abortion should be done and adequate radium treatment given.

MEDICAL ARTS BUILDING.

Rerrhun, E.: Kraurosis Vulvae. Arch. f. Gynäk. 134: 578, 1928.

The author finds that there are three stages of this disease. First there is an hypertrophic stage with sclerema and pressure atrophy in the papillae; second a retrogressive stage with retrogression of the edema and regeneration of the granulation tissue of the atrophic cutis and finally the atrophic stage with scar formation. The author does not believe that kraurosis exists without leucoderma. In typical kraurosis vulvae there is always a definite depigmentation.

RALPH A. REIS.

ACCIDENTAL HEMORRHAGE—ABLATIO PLACENTAE

By John Osborn Polak, M.D., Brooklyn, N. Y.

(From the Clinic of the Long Island College Hospital)

ABLATIO, partial or complete separation of the normally situated placenta, occurs as a comparatively frequent accident in the last weeks of pregnancy and in the course of labor. It is one of the gravest conditions met with in obstetrics, for it is often attended with alarming hemorrhage, shock, and collapse; and the fetal mortality ranges from 65 to 95 per cent.

Frequency.—Ablatio, according to Holmes, is more common than placenta previa. The frequency has been variously estimated at from 1 in 115 to 1 in 894 labors. Holmes claims that many cases are missed, as the bleeding may be slight and examination of the placenta, casual or careless. He places the incidence at 1 in 200. Study of our records tends to support Holmes' claim, for in this series of 4,878 consecutive labors ablatio occurred 16 times, an incidence of 1 in 305. These figures represent only those cases which were diagnosed as ablatio before or during labor and which required treatment, but do not include many cases in which the separation was so slight that no clinical significance was attached to the vaginal appearance of blood at some time during the labor, but in which on routine examination of the placenta, evidence of premature separation of the placenta was apparent. Furthermore, we are convinced from our studies that this accident accounts for a fair proportion of intrapartal fetal deaths.

Ablatio placentae may be apparent or concealed. In the apparent type the lower margin of the placenta is detached and the blood separates the membranes from the uterine wall and is discharged as a frank hemorrhage through the cervix and the vagina, increasing at the time of uterine contraction. *Even in the apparent type the hemorrhage is primarily concealed,* which fact must not be overlooked, for the classical symptoms of ablatio are evident before vaginal bleeding appears. In the concealed type the effused blood collects within the uterine cavity and any one of the following conditions may obtain:

1. The placenta may become detached at the center and the periphery remain adherent. Such a detachment produces a node or boss on the surface of the uterus over the site of the retroplacental blood clot, with resulting uterine asymmetry. The overlying uterine area is exquisitely sensitive and atonic.

2. The placenta may become detached at one edge, upper or lateral, which allows the effused blood to lift the membranes from their uterine attachment. As the blood accumulates, it further separates the placenta and overdistends the uterus.

3. The placenta may be detached at one edge, partially lifting the membranes beyond the margin when the pressure of the accumulated blood may be such as to cause rupture into the amniotic sac above the placental site and allow the hemorrhage to produce an intraovular distention of the uterus.

4. Finally, separation may take place at the lower edge of the placenta and of the adjacent membranes, but owing to the ball valve action of the fetal head which occludes the lower segment of the uterus, the blood may be prevented from escaping. It is in this type of case that upward displacement of the presenting part confirms the diagnosis by allowing the escape of blood and blood clots.

Causes.—These may be grouped into those which are predisposing and those which may be considered as exciting. The predisposing causes are *toxemia, torsion,* and *endometrial* disease.

It is a well-known clinical fact that the placental attachment at or near term is a very loose one due to the fatty changes which are going on in the placenta preparatory to labor. This condition is necessarily exaggerated when certain placental areas are the seat of numerous infarcts. Chronic nephritis and hematogenous infections during pregnancy produce infarcts. Premature separation does not occur in true eclampsia, though the uterus is frequently in tonic spasm. In contrast it is relatively common in the chronic nephritic patient or in the woman who gives a history of antepartum infection. Both Kellogg and Young have called attention to the marked toxic symptoms which are present in many cases of ablatio, and Young has attributed these to the presence of the red infarct and blood resorption.

Uterine torsion is probably the next most common predisposing factor. There is some degree of uterine torsion present in every pregnancy; when this is extreme, there is definite blocking of the return venous circulation which produces minute hemorrhages in the spongy layer of the decidua basalis, which loosens the placenta so that with the occurrence of active uterine contractions, separation takes place. In cases of extreme torsion towards the right, placentas located on the left lateral wall of the uterus are more liable to separate than those having a right-sided attachment. I believe that torsion with the consequent engorgement of the uterine tissues is a factor in the etiology of both abortion and premature separation. This opinion is based upon the clinical fact that since I have taught my patients to take the knee-chest position for ten minutes three times a day throughout pregnancy, the incidence of both of these conditions, in my personal practice, has diminished. As soon as the diagnosis of pregnancy is made, each patient is drilled in the manner of assuming the knee-chest posture and in the method of distending the vagina with air when in this posture. At each revisit my nurse has the woman take this position and corrects any errors in this performance.

We have produced in animals placental separation by excessive torsion of the uterus and by ligation of the uterine and ovarian veins on one side.   Similar experiments were done by Morse and reported to the American Gynecological Society.

Endometrial disease is a more common cause of abortion and placenta previa than it is of premature separation, though there can be no doubt that it figures in the etiology of ablatio, and, furthermore, multiparity favors endometrial hyperplasia.   Among the exciting causes may be mentioned direct trauma, such as kicks, falls, blows, and violent muscular effort, such as the lifting of heavy weights.   The fact that trauma actually figures in the causation of this accident is illustrated in our records of admissions, for among the working class most of our cases were admitted on Saturday or Monday nights, with histories of sexual trauma or of doing a heavy wash or lifting a portable wash tub. Another group occurred in summer during the excursion season when blows upon the abdomen in boarding an open car are relatively common.   During the period when it was fashionable to use pituitary extract to expedite the first and second stages of labor, ablatio was more frequent.

The experimental observations on animals by Browne at the University College in London, confirms the clinical impressions of the importance of nephritis.   Browne showed that if chronic nephritis has been caused by a previous injection of sodium oxalate, accidental hemorrhage can be induced by injection of uranium nitrate followed by an injection of Bacillus pyocyaneus.   Provided chronic nephritis is present, there is no need to inject uranium, as hemorrhage can be induced by an injection of Bacillus pyocyaneus alone.   In contrast, he found that in the absence of chronic nephritis, injections of Bacillus pyocyaneus are not usually sufficient to cause hemorrhage, even though the injections of the organisms have caused an acute nephritis.   On the other hand, in three animals suffering from chronic nephritis, spontaneous antepartum hemorrhage occurred in the second half of pregnancy,—in one of these it occurred twice and in another four times in successive pregnancies.   In all of the animals suffering from experimentally produced chronic nephritis the liver function was normal.   He concluded that all evidence goes to show that the one important predisposing cause of accidental hemorrhage is chronic nephritis.   Clinically, ablatio may be the first sign of a latent chronic nephritis.   In further support of chronic nephritis being the chief underlying cause, O'Connor reports 37 cases in which the symptoms of toxemia were present in 33.

Symptoms.—Ablatio commonly occurs in the last weeks of pregnancy or during the first stage of labor. ·Usually the first symptom is *sudden and severe abdominal pain in the region of the uterus,* at the point of separation; this is always attended with some degree of faintness or collapse.   This in turn, may be followed in the apparent type by a

vaginal discharge of blood, or the escape of blood may be the first sign of the accident. In the concealed variety the blood collects between the placenta, adjacent membranes and uterine wall, and causes stretching of the uterine muscle. In the presence of this foreign body, the coagula, the uterus is stimulated to tonic contraction. The board-like ligneous uterus is exquisitely sensitive to touch, which is diagnostic. The pain is constant and very intense; it may be cramp-like, colicky, or bearing down in character with no intervals of cessation as in normal labor. *Some degree of shock always exists* even when there is no great loss of blood, as evidenced by pallor, perspiration about the mouth and forehead, fall in systolic pressure, and change in the rate and character of the pulse. The signs of hemorrhage, whether the bleeding is concealed or apparent, are always progressive. Hourly hemoglobin estimations, repeated red cell counts, and frequent pulse and blood pressure readings give an index of the amount of blood loss and its effect on the woman. Occasionally in the concealed form a node or boss forms on the uterine surface, causing asymmetry; this corresponds to the site of the retroplacental blood collection. This swelling is always excessively tender, the retained massed coagula change the shape of the uterus, and it may rapidly increase in size. In the apoplectic form an effusion of blood may take place into the bundles of uterine muscle fibers, separate them and impair their power of contraction, hence the labor pains are of poor quality but the uterine pain persists. In the presence of this pathologic change the prognosis is most serious for retraction and contraction does not take place and bleeding continues.

The persistent escape of blood serum by the vagina is a symptom of great significance, as it indicates the presence of clots retained within the uterus. The amount of separation is shown by the effect on the uteroplacental circulation; in slight detachments during labor the fetal heart may not be disturbed but as the separation increases the heart tones are feeble, irregular, or absent.

Diagnosis.—An early diagnosis is all important and should be made before alarming symptoms develop. The woman, usually a multipara at or near term or in the first stage of labor, having some evidence of chronic nephritis, such as a high systolic pressure, edema, or albuminuria, is seized without warning with sudden severe abdominal pain. This is referred to the region of the uterus or just above the pubis and is associated with faintness, pallor, or some degree of shock. Or the first sign may be uterine pain and vaginal bleeding. Such a story at once suggests ablatio. Abdominal examination at this time will reveal a sensitive ligneous uterus with no periods of relaxation. By vaginal touch the cervix and lower segment seem pressed down into the vagina, giving prominence to the vaginal part of the uterus, though the presenting part may be above the brim. Upward displacement of

the presenting part may allow the escape of blood and clots. When bleeding occurs in the later months of pregnancy or during labor, it must be differentiated from placenta previa, uterine rupture, and premature labor. Bleeding from low implantation of the placenta may be easily mistaken for accidental hemorrhage, except that in the former the onset is painless and on pelvic examination we find the classical signs of previa. Rupture of the uterus occurs later in labor; the membranes have usually ruptured and there are other signs of protracted labor and disproportion or else there is a history of a previous myomectomy or cesarean wound. It is attended with a cessation of labor pains, *recession of the presenting part, diminution in the size of the uterine tumor,* and *when complete, with the development of a separate abdominal tumor.* Premature labor may be attended with slight vaginal bleeding but has none of the diagnostic signs of the more serious lesions.

Prognosis in ablatio is always serious, less so in the apparent variety than when the bleeding is concealed, for frank vaginal bleeding always alarms the woman or her family and prompt medical aid is sought. The condition can be readily recognized and proper treatment instituted. In the concealed type the mortality is much higher, as often the accident is not recognized until the woman is in a serious condition. The maternal fatalities result from hemorrhage, trauma, shock, and sepsis, and range, according to available statistics, from 2.6 per cent to 66 per cent. In the study of these figures it is interesting to note that the mortality rate in hospitals having a prenatal clinic, is materially lower than in those institutions with emergency services. For example, Greenhill at the Chicago Lying-In Hospital, had but 3 deaths in 82 cases, and Burgess at the Montreal Maternity Hospital had 6 in 801, while our ratio was 1 in 16. The fetal mortality varies from 60 to 95 per cent chiefly from asphyxia due to interference with the uteroplacental circulation. The chances for both mother and fetus are better in multiparous births than in primiparous labor. Any operative procedure on a patient in shock or in the presence of pronounced anemia is extremely hazardous. The prognosis is also in a degree dependent upon the form of treatment instituted. In the 16 cases of frank separation which are the basis for this paper, but one mother died, and her death can be charged to the manner in which her case was handled.

Treatment.—As soon as a diagnosis of ablatio is made, treatment must be instituted. What plan of procedure is to be adopted will depend upon certain obstetric factors; i.e., (1) the period of gestation; (2) the parity of the woman; (3) whether or not the woman is in labor; (4) the condition of the membranes; (5) the condition and the amount of dilatation of the cervix; (6) the amount of blood loss; (7) the general condition of the patient, and finally, upon the presence or absence of infection. A woman should be considered potentially in-

feeted when she has had vaginal manipulations, through an unprepared vulva. The general indications are to empty the uterus and control the hemorrhage—but how?

General Considerations.—When the accident occurs during pregnancy with a nonviable fetus, the treatment is similar to that of an inevitable miscarriage and depends upon the degree of dilatation and the amount of bleeding. When it occurs in the latter weeks of pregnancy or during labor, the indications are to combat shock and control further bleeding. This is done by a hypodermic of morphine, the application of heat to the body, and the intravenous injection of 50 c.c. of a 50 per cent gum-glucose solution. Before injecting the glucose, the pulse and systolic pressure should be taken and recorded, the hemoglobin and red cell count estimated, and the blood grouped and matched for transfusion. *It should be accepted as a general rule that no operative procedure on a bleeding case be undertaken, before a blood transfusion is given.* Furthermore, it should be remembered that the employment of a general anesthetic immediately after transfusion produces biochemical changes in the blood which may be serious to the patient; hence, operative procedures done under local anesthesia and analgesia have an advantage. The hemorrhage is controlled by emptying the uterus and with the postpartum pack. When this accident occurs in the presence of a living viable child, in a primipara with unprepared soft parts, not in labor or in the first stage of labor, blood transfusion followed by cesarean section under local infiltration anesthesia should be the procedure of choice. Unfortunately, it is but seldom that such conditions obtain, for in the patient in labor with either apparent or concealed bleeding, a ligneous uterus and dilating cervix which is seen soon after the accident has occurred, the conservative plan of treatment has given us the most satisfactory results. For the woman in shock who has sustained any considerable blood loss will not stand trauma or anesthesia.

The conservative plan employed in the management of our cases is as follows: The pain and shock are relieved by a hypodermic injection of ¼ or ½ grain of morphine; the vulva is clipped and scrubbed, and the vagina sterilized by the instillation of a 4 per cent mercurochrome solution. The membranes are ruptured and the vagina is firmly packed with soaked gauze; the vagina and fundus are carefully measured, and a Beck abdominal binder to control further uterine distention is firmly applied. If the presenting part is in the pelvis and there is no bony disproportion, 3 minim doses of pituitary extract are given hypodermically at twenty-minute intervals. The pulse, systolic pressure, hemoglobin, and red cell count are watched by half-hour and hourly readings. If the labor is progressing, as shown by the effacement and dilatation of the cervix and the descent of the presenting part and the quality of the pulse, the systolic and hemoglobin readings are maintained, the

patient is allowed to deliver spontaneously or the labor is terminated with low forceps. As the child's head passes the vulvar ring, a hypodermic of ½ an ampoule of pituitary extract is given and the uterus followed down with the hand on the fundus; the placenta is then expressed with the first contraction, or if there is any delay, it is removed manually, and the uterus is emptied of its retained coagula, when it usually contracts and controls further bleeding. We have, however, seen it fail to do this; so it has been our custom to pack it firmly with iodoform gauze, as continued oozing may change the favorable outcome. With the hemorrhage controlled, our attention should next be given to combating the acute anemia and its effects by posture and blood transfusion. When, however, the conservative plan fails to arrest the intrauterine bleeding and the uterus becomes overdistended with blood or the condition of the cervix offers an obstruction to speedy spontaneous delivery, conditions which are quickly recognized by rise in the pulse rate, drop in systolic pressure, fall in the hemoglobin percentage, and increase in the size of the uterine tumor, or the cervix fails to efface and dilate; radical measures must be taken without delay. These predispose that the patient is in a well-equipped hospital where she can have the benefit of modern scientific methods. Under such conditions her blood should be cross matched (it has already been grouped) and a blood transfusion of at least 500 c.c. given by either the Unger or Soresi method. While this is being done, the abdomen is prepared, quickly opened under local infiltration anesthesia, and the child delivered by hysterotomy. When it is possible to eventrate the uterus before incising it, the operation can be shortened and further blood loss absolutely controlled by placing two long Keith clamps on the broad ligaments, thus clamping the uterine and ovarian arteries before opening the uterus and delivering child and placenta. This seems to prevent the shock which is apt to take place when the uterine contents and the mass of accumulated coagula are removed. Theoretical objection is made to this procedure on the grounds that it takes away all chance for the child, necessitates a larger abdominal incision, and sacrifices a uterus which possibly might be saved. These objections do not counterbalance the advantages, for section followed by hysterectomy is only indicated in those few cases where the separation is complete, where hemorrhage into the muscle fibers and hemorrhagic effusion under the peritoneal covering of the uterus has taken place. Such cases demand a rapid hysterectomy.

Case 15 of this last series falls into this group: A multipara aged thirty-eight years, mother of eight living children, was admitted to our service in March, 1930, about six hours after the first signs of separation. She was in severe shock with a pulse of 100, a systolic pressure 80/50, and a hemoglobin of 55 per cent. The uterus was tonic and the cervix, which was hard and scarred, admitted two fingers. The resident physician gave her morphine, ruptured the membranes, and applied the Beck binder. Her blood was examined for control, she was grouped,

and donors were called. After cross matching, a blood transfusion of 500 c.c. was given which raised her hemoglobin to 60 per cent and her systolic pressure to 120. The vagina was then tightly plugged and she was watched for two hours, when it was noted that her pressure had fallen to 70 and the hemoglobin to 30. The head did not fill the lower segment and the cervix showed no sign of effacement or further dilatation. She was given another transfusion of 800 c.c., and under an additional dose of morphine and infiltration anesthesia, the abdomen was opened, the child delivered by hysterotomy and the uterus removed. Immediately on clamping the broad ligaments the quality of the pulse began to improve and was of fair quality at the end of the operation. After putting her back to bed, a third transfusion of 500 c.c. of blood was given. Her recovery was afebrile and uncomplicated. Pathologic study of the uterus and adnexa which were removed, showed a deep bluish effusion of blood into all of the cellular tissues under the peritoneum and a wide separation of the folds of the broad ligaments by effused blood. More detailed investigation showed the muscle bundles of the uterine wall separated by masses of red blood cells. This case illustrates the value of frequent pulse, pressure, and hemoglobin readings as an index of what is going on within the uterus, and also of the enormous quantity of blood which has to be replaced in some of these separations, as well as the tolerance of the woman to properly matched new blood in acute hemorrhage.

<div align="center">

TABULATION OF SIXTEEN COMPLETE SEPARATION CASES

Incidence 16 in 4,878 Consecutive Labors

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Mortality:	
Maternal (age from 20 to 43 years)	1
Primipara	3
Multipara	13
Mortality:	
Fetal	14
Period of Gestation:	
At term	5
After eighth month	6
After seventh month	3
After sixth month	2
Method of Delivery:	
Spontaneous labor	12
Low forceps	2
*Manual dilatation and version	1
Hysterectomy	1
Etiology:	
Nephritic	7
Trauma	3
Syphilis	1
Cause unknown	5
Presentation:	
Vertex	14
Breech	2

*Fatal Case: Ruptured uterus, hysterectomy, after manual dilatation and version.

The one fatal case was the first in this series, death being due to a rupture of the uterus resulting from manual dilatation and version. The patient went into shock following the extraction, reacted on transfusion, but died in a few hours after a hysterectomy (under general anesthesia) to remove the traumatized uterus. A woman can stand the

loss of enormous quantities of blood if there is no tissue trauma. It is anesthesia and trauma that kill.

COMMENTS AND CONCLUSIONS

A review of the literature with a detailed study of the case histories in the two series which I have reported to this Association in 1922 and 1930, bring out certain clinical facts:

(1) That minor degrees of ablatio are relatively frequent accidents and contribute to the uncontrollable part of fetal mortality.

(2) That both clinical and experimental studies show chronic nephritis to be the most constant predisposing cause.

(3) That the diagnosis is apparent from the history and the symptom-complex.

(4) That the prognosis depends largely on an early diagnosis and the prompt establishment of rational treatment.

(5) That trauma, blood loss, and toxemia reduce individual resistance—all three are commonly present in ablatio.

(6) That the conservative plan instituted early with timely and generous transfusion offer the woman the best chance, and, finally, in those rare cases in which the uterine muscle bundles are infiltrated and blood effusion takes place into the subserous connective tissues, hysterectomy, under local anesthesia, after preliminary transfusion, is the procedure of choice.

20 LIVINGSTON STREET.

Jameson: Tuberculosis of the Female Pelvis. Am. Rev. Tuberc. 22: 72, 1930.

It is the general impression among workers in tuberculosis that renal and pelvic lesions are seen much less frequently among patients suffering from active pulmonary tuberculosis than in general hospital work. As a matter of fact in the last 38 autopsies on women who had died of tuberculosis in Saranac Lake not a single case showed gross evidence of pelvic tuberculosis, while in the last 24 salpingectomies done at the Saranac Lake General Hospital for all causes, 7 showed tuberculosis. From a thorough study of the extensive literature the writer concludes that tuberculous pelvic disease occurs in about 8 per cent of women with pulmonary tuberculosis, that the diagnosis can be made with a reasonable degree of certainty and that the roentgen rays offer a feasible type of conservative treatment. Surgery is best restricted to cases not relieved by other methods.

EHRENFEST.

PLACENTA PREVIA

By Arthur H. Bill, M.D., Cleveland, Ohio

THE ultraconservatism in the practice of obstetrics which has been characteristic of the medical profession of this country has been much in evidence in the treatment of placenta previa. Reluctance to adopt measures which seem radical has no doubt in some instances served to retain a proper balance of obstetric procedure. However, in other instances it has retarded progress and definitely caused the continuation of high mortality by encouraging adherence to obsolete methods.

I fear that this is the case in the treatment of placenta previa. In view of the satisfactory results obtained, it has seemed to us that one of the greatest advances in modern obstetrics has been seen in the treatment of placenta previa, and yet results reported from some prominent clinics are most discouraging. An analysis of these reports shows that older methods are still in vogue and that practically the only difference between the methods of twenty-five years ago and of today, lies in the fact that the accouchement forcé has been almost universally given up. Rejoicing in the relegation of this most disastrous procedure to the scrap pile, we learn with dismay of attempts recently made to revive it disguised by a new name, the Delmas method, and masked by spinal anesthesia. If we were to eliminate from the statistics of twenty-five years ago the maternal mortality rate of accouchement forcé which was not uncommonly as high as 30 and even 60 per cent in cases of central placenta previa, and were to include in these statistics only the cases treated by Braxton-Hicks version and the cervical bag, we would find a maternal mortality of from 6 per cent to 13 per cent, averaging about 10 per cent. The average maternal mortality today where these same methods are used is probably about 10 per cent.

In cases of complete or partial placenta previa, that is cases in which the placenta definitely overlaps any part of the os, only three procedures are worthy of consideration. First, cesarean section; second, the cervical bag; third, the Braxton-Hicks version without extraction. In this country apparently the Braxton-Hicks version has never been popular and is very little used today. Abroad, however, it is still used somewhat extensively. However, the mortality rate for the mother from this method is seldom lower than 6 or 7 per cent and more often 10 per cent and the fetal mortality is naturally very high because the best results for the mother are obtained when no extraction is performed, the child being used merely as a tampon. With

its excessive mortality for both mother and baby this method should be considered only when facilities for better procedures are not available. As a last resort, in a place where there are no facilities for cesarean section, where no cervical bag or packing is available, a physician should bear in mind that by proper manipulation the baby can be used as a tampon to control hemorrhage. Such emergencies are rare and certainly would not arise in any locality within reach of a well organized medical center. In most instances it would be better to avoid all manipulation until proper help and facilities are available. The bag method would naturally offer about the same results for the mother as the Braxton-Hicks version without extraction and of course causes less fetal mortality.

The following are some characteristic reports of cases of placenta previa published during the last three years.

GROUP I. TREATED CHIEFLY BY OLDER METHODS

G. L. Broadhead and E. G. Langrock, 1927
    Cases   165
    Maternal mortality   10.9 %
    Fetal mortality   66.7 %

P. Ramos and J. Basan, 1927
    Cases   104
    Maternal mortality   7.68%

L. A. Ledoux, 1927
    Cases   66
    Maternal mortality   12.1 %

O. Korthauer, 1927, Bremen Women's Clinic
    Cases   96
      9 Braxton-Hicks version: Maternal mortality 11.1 %
                             Fetal mortality   88.8 %
        8 Version: Maternal mortality 50   %
                             Fetal mortality   85.5 %
      29 Cesarean section: Maternal mortality 6.9 %
                             Fetal mortality   17.3 %
or   67 Cases not delivered by cesarean section:
                             Maternal mortality 11.9 %
                             Fetal mortality   61.2 %
      29 Cases delivered by cesarean section:
                             Maternal mortality 6.9 %
                             Fetal mortality   17.3 %

F. C. Irving, 1927
    Cases   57
    Maternal mortality   3.5 %
    Fetal mortality   57.9 %

J. Futh, 1928, Coblenz
    Cases   –   –   606
    Maternal mortality   14   %
    Fetal mortality   39.8 %

L. H. Douglas and I. A. Siegel, 1928
    Cases   64   All by version
    Maternal mortality   6.25%
    Fetal mortality   53.8 %

Williamson, 1929
    Cases   65   %
    Maternal mortality   7.7 % Voorhees' Bag Method
    Fetal mortality   47.7 %

F. H. Lacey, 1929
    Cases   562
    Maternal mortality (Exclusive of cesareans)   8.88%
    Fetal mortality (Exclusive of cesareans)   64.64%
J. Karstad, 1930
    Cases   361
    Maternal mortality   4.7 %
    Fetal mortality   57.4 %
Summary.—Total cases, 2117; maternal mortality   9.68%

<center>GROUP II. TREATED CHIEFLY BY CESAREAN SECTION</center>

E. Frey, 1927
    Cases   79
    Maternal mortality   2.53%
M. Henkel, 1928
    Cesarean section in primiparae and most
        serious cases   83
    Deaths   1 or 1.2 %
DeLee, Unpublished Report
    Low cervical section   44
    No deaths
A. H. Bill, 1927
    Series ''B''—Prophylactic blood transfusion
        and cesarean section   56
    Maternal mortality (1 death)   1.78%
    Fetal mortality   32.1 %
Summary.—Total cases, 262; maternal mortality   1.78%

The only uniformly satisfactory results are seen in the series of cases in which the procedure of choice was cesarean section and especially where combined with prophylactic blood transfusion in the more serious cases. However, I am not so much concerned with the reports in the literature as I am with the principles underlying the treatment of placenta previa and the reasons for the difference in maternal mortality rates between the older methods and the newer methods.

A placenta previa death is usually one from postpartum hemorrhage. There are two distinct reasons for these postpartum deaths: first, injury to the cervix and lower uterine segment brought about by manipulation necessary to extract the child through the birth canal; second, general atony of the patient or shock resulting from previous loss of blood and the effect of this condition upon the contractile power of the uterine muscle.

While better results are undoubtedly obtained by those methods which bring about a gradual dilatation of the os, such as the cervical bag or the Braxton-Hicks version without immediate delivery, it must again be emphasized that any method which causes a stretching of the placental site is very apt to give rise to postpartum hemorrhage even though there be no apparent laceration of the cervix. In a previous paper on placenta previa I illustrated this point with several cases treated by the bag method and in which death from hemorrhage had occurred. Autopsies showed no apparent laceration of the cervix in these cases and still there was bleeding from the placental site which was absolutely uncontrollable. In some such cases as these there is undoubt-

edly actual injury to the placental site not apparent in the vaginal portion of the cervix. In others probably the relatively poor contractile power of the lower segment of the uterus is not sufficient to control bleeding from the uterine sinuses when located in this part of the uterus. Clinically it has been our experience that when there has been no dilatation of the lower segment of the uterus and there is therefore no disturbance of the placental site, the baby having been extracted from above, postpartum hemorrhage from the placental site is practically nil. However, in any case in which there has been dilatation whether accomplished manually, by the baby or bag, there is an added element of danger of postpartum hemorrhage. It would seem, therefore, that the only safe method of delivery of the baby in cases of placenta previa is one which leaves the placental site undisturbed and of course the only method which will do this is abdominal cesarean section.

The second cause of postpartum hemorrhage deserves just as much consideration as the method of delivery. The delivery of a baby is never a bloodless operation. Therefore, the additional loss of blood caused by the delivery is very likely to throw a patient who has lost considerable blood into shock, even though she does not seem to be in this condition before delivery. We must also remember that loss of blood on the part of the patient causes an atonic condition of the uterine muscle which in turn causes further hemorrhage, all combining to develop a vicious circle. If in delivering a patient with placenta previa one does not anticipate the development of this vicious circle and prevent its occurrence by prophylactic blood transfusion the results may be disastrous even though the best method of delivery be used. All patients with placenta previa do not require blood transfusion and it is somewhat difficult to formulate a definite rule as to when to transfuse and when not to transfuse. However, it is far better to err on the side of safety than to encounter an uncontrollable postpartum hemorrhage. We are now accustomed to transfuse cases in which the systolic blood pressure is below 100 and in which the red blood count is as low as 3,000,000. Of course one must try to estimate the amount of blood lost and also take into consideration the general appearance of the patient and other evidence of impending shock. The rapidity of the pulse is of somewhat minor importance, for in some of these cases there is a moderately slow pulse even though the blood pressure is extremely low. In view of what I have said it must be clear that we are strongly in favor of the prophylactic blood transfusion rather than transfusion given after delivery, often as a last resort. The blood transfusion in these cases is given either immediately before the delivery or simultaneously with the delivery. In making a diagnosis we do not lay so much stress upon the variety of placenta previa as upon the mere fact of its existence. In other words

we make no serious attempt to distinguish between a central and partial placenta previa but feel that in any case in which there is placenta previa and hemorrhage with little or no dilatation of the os whether in primipara or multipara, cesarean section is indicated. We do, however, try to distinguish between placenta previa and accidental separation of the placenta, not so much that the treatment would be different in the two types of cases as that the differentiation helps in estimating the probable amount of blood which the patient has lost. For example in placenta previa the amount of external bleeding shown upon the patient's clothing or on the bed, closely corresponds with the total loss of blood; while in cases of premature separation of the placenta one might be seriously misled by a small amount of external bleeding and think that the patient had not suffered much loss of blood whereas the uterus itself might be filled with concealed blood. We make our probable differentiation between these two conditions chiefly by abdominal examination aided somewhat by rectal examination.

In placenta previa abdominal examination reveals practically the same condition as any normal case, and in most cases the fetal heart is still heard. In cases of premature separation of the placenta the abdominal findings are very different. The uterus is usually tense and somewhat distended and the fetal heart is not usually heard, never in cases of complete separation of the placenta. The location of the uterine bruit is also of considerable help in the diagnosis of placenta previa. It is often possible to trace this bruit into the lower uterine segment and across the symphysis pubis, whereas if the placenta is normally situated the uterine bruit is not heard over the lower uterine segment. On rectal examination it is usually possible to distinguish the thickened mass of placenta between the examining finger and the presenting part even though there is no dilatation of the os. We never attempt to make a diagnosis by vaginal examination. While the diagnosis of placenta previa made in this way is of course not as certain as if one inserted the finger into the os and actually felt the placenta, it is vastly more important to avoid all vaginal examinations than to make an accurate diagnosis of the variety of placenta previa. The diagnosis is invariably confirmed and the degree of overlapping of the os by the placenta determined during the operative delivery.

In view of our firm belief in the importance of keeping away from the placental site during the operation we have from choice performed the classical cesarean section. In cases which have been examined vaginally and in which there is a suspicion of infection, it is preferable to perform the low cervical operation or even the Porro operation. In two of the cases of our present series the Porro operation was performed for this reason. However, it is surprising how few contaminated cases of placenta previa we see. This can be attributed only to intensive teaching for many years that vaginal examinations

should not be made in cases of antepartum hemorrhage. Undoubtedly this policy quite generally followed in Cleveland is in a large measure responsible for our good results. All cases of antepartum hemorrhage should be in a hospital if one is available. It is safer to deliver immediately and this should always be done if the hemorrhage continues or if the baby is viable. However, there are a few exceptions to this rule, namely, those cases in which the first hemorrhage has promptly stopped and the patient is not far enough advanced in pregnancy to assure a living child. We sometimes allow a patient of this type to continue in her pregnancy but under the absolute provision that she be in the hospital and in bed. Rather than allow her to be at home and to be up we insist upon delivery. However, in a number of cases with thorough cooperation on the part of the patient it has been possible to allow the pregnancy to continue and eventually to deliver a living child.

The following statistics are from the Maternity Hospital of Cleveland. In 1927 I reported a series of cases delivered according to our present methods from January 1, 1922, to May, 1927. In this list there were 56 cases with one maternal death. In the present list I have brought this series up to July 1, 1930, as follows:

JANUARY 1, 1922, TO JULY 1, 1930

	Total deliveries	34,343
	Cases of placenta previa	104
	1 placenta previa in 330 cases	
104 cases of placenta previa	Complete	47
	Partial	27
	Marginal	30
Method of delivery	Cesarean section, classical	78
	Cesarean section, low cervical	2
	Cesarean section, Porro	2
	Podalic version (bag)	15
	Forceps	5
	Spontaneous	2
Prophylactic blood transfusion and cesarean section		23
Maternal deaths	2 or	1.92%
Fetal mortality (Died 16; Stillborn 16)	32 or	30.76%
Cases requiring blood transfusion		22.11%
Cases delivered by cesarean section		78.84%

In this series of cases there was only one death from hemorrhage. This case was fully described in my previous paper on placenta previa and was largely attributable to the obstinacy of the patient's husband who not only refused to give his consent to delivery but also refused to act as donor for a blood transfusion. The patient was really moribund at the time of treatment.

The cases which were treated by version and forceps were those of marginal placenta previa in whom, at the time of the first definite hemorrhage there was sufficient dilatation of the os to permit delivery by these methods. In the five cases delivered by forceps, preliminary

rupture of the membranes, allowing the fetal head to descend into the cervical canal, was sufficient to control hemorrhage. These patients were chiefly multipara. It is interesting to note that our records show a continually decreasing number of cases treated in this way. In fact in the last half of this series only four patients were delivered by version.

While our chief interest is of course in the reduction of maternal mortality it is interesting to note that more than two-thirds of the babies were saved. In other words the methods which give the best results for the mother are also responsible for the lowest fetal mortality.

CONCLUSIONS

All cases of placenta previa should be treated in the hospital if possible and should be sent there immediately without vaginal examination or packing.

A careful estimation of the loss of blood should be made and in all cases of doubtful operative risk, prophylactic blood transfusion should be performed and sufficient blood given to insure the safety of the patient.

If there is little or no dilatation of the os, cesarean section should be performed whether the baby is alive or dead, for the viability of the child has no bearing on the choice of method for delivery.

If there is considerable dilatation of the os and the fetal head is engaged, simple rupture of the membranes may control hemorrhage until the baby may be delivered by forceps; or if the fetal head remains high, podalic version may be performed. These procedures should be used only in the marginal variety of placenta previa.

OSBORN BUILDING.

Mayer and Dejardin: Clinical Considerations of the Surgery of the Pelvic-Utero-Adnexal Sympathetics. Bruxelles Méd. 10: 125, 1929.

These authors feel that resection of the presacral, the hypogastric, or the ovarian sympathetics for the relief of certain types of pelvic pain has not received the attention which the procedure warrants. They report 10 cases in which one or more of these procedures has been carried out with success. In 4 cases the operation was done for severe intractable dysmenorrhea, while in one the pain was intermenstrual in type. In 3 others the indication was severe pain in inoperable pelvic carcinomas, and the operation was carried out as a palliative measure. Finally in 2 cases it was done to prevent pain which sometimes occurs following extensive operations for pelvic inflammatory disease.

THEODORE W. ADAMS.

PREGNANCY AND LABOR IN THE ELDERLY PRIMIPARA

A Study of Over 300 Cases

By James K. Quigley, M.D., Rochester, N. Y.

IT IS hard to understand why childbearing in the elderly primipara has been thought to be so very difficult and so fraught with dire consequences. This opinion prevails quite generally in the medical profession and is shared also by the laity, particularly by the parturient. Yet most of those who have written upon the subject believe, as I shall attempt to prove in this brief presentation, that not only is there little added risk to the mother bearing her first child after thirty years of age, but that the fetal mortality is no higher than that generally encountered.

Few textbooks discuss the subject, possibly because, in the opinion of their authors, labor differs so little in primiparae, young and old, as not to deserve special consideration. Williams[1] says, "Labor is usually more prolonged in elderly than young primiparae, that is after the thirtieth year." According to Ahlfeld it averages seven hours longer in the former though Varnier states that the difference is very much less. At the same time the latter author points out that forceps are much more frequently required in old primiparae.

DeLee[2] says "The best years for women to bear children are from eighteen to twenty-five. With added years the function of childbearing is attended with increasing difficulties although these are all exaggerated in the popular mind. In general it may be said that in older women the pregnancy disorders—hyperemesis, abortion and premature labor—are more frequent. Contracted pelves, usually the justo minor, the infantile or the masculine types, are oftener met. Labor is longer in all three stages, premature rupture of the membranes, cervical and perineal rigidity are more common—indeed the soft parts may be so inelastic that they tear in all directions like old rubber, when stretched. Face, breech and shoulder presentations, occiput posterior positions and deep transverse arrest, are more frequent while the action of the uterus may leave much more to be desired etc., etc. All these retard labor and necessitate frequent recourse to forceps. They increase the danger to mother and child; for the one, lacerations and infections; for the other cerebral injury and death from asphyxia. Postpartum hemorrhage from lacerations and uterine atony have also been noted. Nursing is less likely to be adequate."

This rather gloomy view of the situation is not held by Berkeley and Bonny.[3] "In our experience the course of pregnancy in a woman over thirty years of age differs but little from that in one under thirty. At most the labor is a little prolonged and necessity for operative delivery is rather more frequent."

The percentage of elderly primiparae seen in private practice is much greater than in public ward service. There are several probable reasons why this is so. First, private patients at this age are more apt to be in better financial condition. Second, the generally considered opinion that labor in this class of patients is very apt to

be difficult induces the patient to seek the services of a private physician, usually an obstetrician. Third, early marriages are more common among the less well-to-do. The incidence as found in this series was 234 in 2200 deliveries in my private patients or 10.5 per cent, as against 70 in 4106 ward patients or 1.7 per cent.

Age Grouping.—Rather than consider each age separately I have divided them into three age groups; viz., thirty to thirty-four inclusive, thirty-five to thirty-nine inclusive and those forty years and older. (Table I.)

TABLE I. AGE GROUPING

PRIVATE PATIENTS																
Age	30	31	32	33	34		35	36	37	38	39		40	41	42	43
Number of cases	47	34	24	24	21		21	14	18	13	4		8	3	2	4
Group totals		148						69						17		

WARD PATIENTS																			
Age	30	31	32	33	34		35	36	37	38	39		40	41	42	43	44	45	46
Number of cases	18	11	6	7	8		5	1	1	2	4		3	1		1	1		1
Group totals		50						13						7					

The number of cases included in the forty and over group is not large enough to consider seriously as a group, but the first two groups are worthy of consideration and the findings in the entire series are significant, particularly if they coincide with those of others who have written upon this subject. The available data concerning my private cases were more detailed than in the public ward cases, so a comparison of the two series is possible only in certain features.

Sex of the Children.—The sex of the children showed a preponderance to the male, 137 to 109; this is similar to Ahlfeld's estimate of 137 to 100 and Hecker's 133 to 100 in elderly primiparae.

Twin Pregnancies.—A greater frequency of twin pregnancies has been attributed to the elderly primiparae. Prinzing gives an incidence of 4.14 per cent (quoted from Spain[4]). "One to every 44 in elderly primipara as compared to 1 in every 224 before thirty" (quoted from Freeland[5]). In this series there were 3, or 1 to 101.

COURSE OF PREGNANCY IN ELDERLY PRIMIPARAE

Toxemia.—Nausea and vomiting and late toxemia of pregnancy are said to occur more often in primiparae over thirty. Of 232 women in this series 108 had no nausea or vomiting, 109 had slight disturbance from this complaint, usually of the morning type only, while 15 suffered to a moderate degree. There were no cases of true hyperemesis and none requiring hospitalization.

Of late toxemia there were one fulminating eclampsia at six months, 7 preeclamptics, 6 cases of moderate severity, and 22 mild cases.

Nausea and Vomiting				_Toxemia_			
None	108 or 46.5 per cent		Mild	22 or 9.0 per cent			
Mild	109 or 46.9 per cent		Moderate	6 or 2.5 per cent			
Moderate	15 or 6.8 per cent		Preeclamptic	7 or 3.0 per cent			
Hyperemesis	0 or 0.0 per cent		Eclampsia	1 or 4.0 per cent			

These findings are similar to those of Schulze.[6] The percentage of nausea and vomiting differs little from the general average for all ages, including multiparae; the rate for toxemia, mild and severe, is probably considerably higher; nephritic toxemia, which was included in this series, might account for the higher incidence in older women.

Abortions and Premature Labors.—Interruptions of pregnancy, according to Williams, are more frequent in old primiparae. I do not believe this to be true of this group, for only 20 of the 234, or 8½ per cent, had had early abortions. There were 28 premature labors in this series due largely to toxemia of pregnancy; neither is this incidence of 1 to 11.7 much above the average.

Syphilis.—One patient gave a 4 + Wassermann test and only on going into her history very carefully was it found that she had had interstitial keratitis at the age of twelve, a symptom of congenital infection.

Fibromyomas of the Uterus.—There were only 9 cases in which fibroids were discovered. In 3 the growth was so extensive as to preclude pelvic delivery, and in another while the tumor was not sufficiently large to obstruct, we believed, after a thirty-hour labor, that the uterine musculature was so involved by multiple small fibroids as to prevent cervical dilatation and retraction; these 4 patients were delivered by abdominal section. In the remaining 5 the fibroids were no factor in pregnancy or labor. Fibroids are more common in the primiparae over thirty than in the young primiparae, but no more common than in multiparae over thirty.

Induction of Labor.—Thirty-seven patients responded to simple induction by quinine and castor oil. I believe that labor in these cases was shorter and there was less dystocia than in the labors which started spontaneously. The longest labor was twenty-six hours and thirty minutes, and the shortest was three hours and fifteen minutes; the average being eleven hours forty-five minutes. There were 5 bag inductions, 3 for toxemia of pregnancy, 1 for dry labor with inertia, and 1 in premature macerated fetus (placental infarction). I use the hydrostatic bag to induce premature labor less frequently than formerly in primiparae, because of the uncertainty of its action; furthermore, the infant mortality of labor induced by hydrostatic bags is higher than in spontaneous labor. For these two reasons I do not agree with Spain who suggested routine induction of labor by the hydrostatic bag at the thirty-sixth week in elderly primiparae. Induction by quinine and oil alone or by the Watson method at estimated full term has a distinct place in the management of primiparae, whether young or old.

Contracted Pelves.—Pelvic contraction, particularly of the male or funnel type, is said to be more common in old than in young primiparae. Of the 234 private patients there were 16 with flat pelves, 4 justo minor, and 6 of the funnel type, a total of 26 or 11 per cent.

TABLE II. PRESENTATION AND POSITION

	30-34	35-39	40-46	TOTAL	
Vertex					
L.O.A.	89	46	15	150 – 48.8 %	⎫
R.O.P.	45	14	3	62 – 20.0 %	⎬ 93.1%
R.O.A.	39	14	3	56 – 18.2 %	⎪
L.O.P.	13	5	1	19 – 6.1 %	⎭
Brow	2	0	0	2 – 0.65%	
Face	1	0	0	1 – 0.32%	
Breech	11	4	2	17 – 5.33%	
Total				307	

Malpresentations and malpositions are supposed to be more frequent in elderly primiparae. In Table II it will be seen that vertex presentations comprised 93.1 per cent of the total as against an estimate of 95 per cent for all cases (Karl Braun 48,449 cases, Schroeder 250,000 cases); a slight decrease in vertex presentations compensated for by an increase in the breech, 5.33 per cent for this series as against 2.7 per cent to 3.11 per cent (Braun, Schroeder). The rate for face presentation is the same as given by these authorities for all cases. Of the vertex presentations there is an increase in L.O.P. positions of 6.1 per cent against 1 per cent, with a probable slight increase in R.O.P. The large percentage of R.O.A. positions is due to the fact that diagnosis of position was made by the house officer at the end of labor rather than at the beginning in the ward cases. In short, the differences in this small series are: an increase in breech presentation of from 3 to 6 per cent and an estimated increase in posterior position of the occiput of 10 per cent.

TABLE III. LENGTH OF LABOR

PRIVATE CASES—207

	30-34	35-39	40-46	ENTIRE SERIES ALL AGES
Shortest labor	2 hr.	2 hr., 40 min.	7 hr.	2 hr.
Longest labor	51 hr.	48 hr.	26 hr.	51 hr.
Average	15 hr., 24 min.	14 hr., 54 min.	17 hr., 6 min.	15 hr., 20 min.
Spontaneous deliveries no prematures	10 hr., 16 min.	11 hr., 30 min.	15 hr., 54 min.	11 hr., 0 min.
WARD CASES—62				
Shortest labor	5 hr., 35 min.	4 hr.	8 hr.	4 hr.
Longest labor	65 hr.	24 hr., 15 min.	17 hr.	65 hr.
Average	20 hr., 45 min.	16 hr.	11 hr.	19 hr., 12 min.
Spontaneous deliveries no prematures	14 hr., 46 min.	16 hr., 40 min.	12 hr., 28 min.	15 hr., 6 min.

It is in this table of length of labor in elderly primiparae that the surprises are found. I say surprises, for it is generally thought that these labors are unusually long. Eighteen hours are a fair estimate of the length of labor in all primiparae. The average of all cases, in this series, cesarean sections excluded, in the private group is fifteen and one-third hours. Lest it be thought unfair to include aided deliveries (foreps and versions) the duration of labor in the patients delivering spontaneously, excluding premature labors, was still lower; viz., eleven hours. In the ward service a much more conservative policy was pursued and the averages were respectively nineteen and fifteen hours. Edgar[7] reported an average of fifteen hours and forty-five minutes in 30 spontaneous deliveries, and the Tarnier clinic reported seventeen and one-half hours for 111 elderly primiparae. Not infrequently labors are unusually short in primiparae between the ages of thirty and forty; for instance, in the age thirty-six group there were 4 labors totaling only twenty-one and one-quarter hours, an average of five and one-third hours. All were mature infants and all were unaided deliveries. One woman of forty delivered herself of a full-term child in eight and one-quarter hours.

TABLE IV.   MODE OF DELIVERY OF 307 BABIES IN PRIVATE AND WARD PRACTICE

	30-34	35-39	40-46	TOTAL
Spontaneous	73 – 36.5%	29 – 35.3%	6 – 25.0%	108 – 35.1%
Forceps				
Low	37 – 18.5%	16 – 19.5%	7 – 29.0%	60 – 19.5%
Mid	62 – 31.0%	17 – 20.7%	6 – 25.0%	85 – 24.4%
High	4 – 2.0%	3 – 3.6%	0 – 0	7 – 2.2%
Cesarean section	13 – 6.5%	17 – 20.7%	5 – 20.8%	35 – 11.4%
Version	6 – 3.0%	0 – 0	0 – 0	6 – 1.9%
Breech delivery	5 – 2.5%	0 – 0	0 – 0	5 – 1.6%

It will be noted that there is a high percentage of forceps deliveries in this report; few of these were difficult, and for the most part were low or low-mid application which were done after it was noted that there was lack of progress after at least two hours in the second stage. My impression is that the characteristics of labor in an elderly primipara are a fairly short, satisfactory first stage, usually with delay in the second stage due either to a thick muscular perineum, or what is more common, to secondary inertia and sometimes to a combination of both. In some instances delivery by forceps was called for because of threatened fetal asphyxia.

Version was done but six times and then for special indications, such as brow presentation, lack of progress after a long time in a posterior occiput where delivery was demanded and cesarean section contraindicated, and in placenta previa.

High Forceps.—Forceps were applied to the unengaged head seven

times; in each case version and abdominal delivery were contraindicated. The fetal mortality of 4 cases or 57 per cent rightly condemns the procedure.

Cesarean Section.—Eleven per cent seems a rather high incidence of abdominal deliveries and yet I have heard the opinion expressed that every primipara over thirty-three or thirty-five years old should be so delivered as an elective measure. Eighteen of these cesarean sections were done only after a test of from eight to fifty-three hours of labor. Of the private case group there were only 9 abdominal deliveries done without a test of labor, as follows:

4 Purely elective	2 Preeclamptic toxemias
	2 Funnel pelves
5 After labor had begun	2 Flat pelves
	1 Extensive fibroid
	1 Cardiac (pulmonary stenosis)
	1 Funnel pelvis

Eighteen patients had trial labors of from eight to fifty-three hours, and most of them were real tests of labor; in each case the head remained high and the competing procedures were high forceps, version, pubiotomy and cesarean section. The exceptions to this were: threatened fetal asphyxia in a woman of thirty-eight for whom I am sure the choice of delivery made possible the birth of a living child, twin pregnancy in a toxic mother with premature separation of the placenta, large fibroids low in the uterus in two patients and small multiple growths in one, and primary inertia after thirty-six hours of labor in a woman who had had four spontaneous abortions. There were three cases of flat pelves, one justo minor, and one funnel pelvis; one case of disproportion due to postmaturity. It is only in the remaining six cases where definite indications were lacking that it might be said that elderly primiparity was the chief factor in deciding for cesarean section.

The value of the child to these six women of thirty-five to thirty-eight years is great; in other words, their chances for a living baby are not as good as in the young primipara who may have many pregnancies, and one is not justified in assuming great risks in difficult deliveries. I believe that after a trial labor in uninfected patients, if the choice lay between high forceps, version, or low cesarean section the last method should be chosen. Cesarean section as an elective procedure before the onset of labor is not indicated except in the case that is complicated by some condition which would demand abdominal delivery in any patient, such as placenta previa, contracted pelvis, or premature separation of the placenta. Malpresentation, such as brow or face, or preeclamptic toxemia should indicate cesarean section more frequently than in the young primipara or multipara; in other words, I believe the relative indications are broadened in the elderly primipara.

RELATION BETWEEN STERILITY OR LOWERED FERTILITY AND DYSTOCIA

It has been claimed that women conceiving for the first time several years after marriage are prone to dystocia, because of inertia, slow dilatation, and rigid soft parts due to hypoplasia of the generative organs. The number of years married before conception was not known in many of these cases, but in the 100 private patients from whom this item was ascertained, the following facts were found.

TABLE V. LOWERED FERTILITY AND DYSTOCIA

	MARRIED 1 YEAR OR LESS	MARRIED 5-20 YEARS BEFORE CONCEPTION, AVERAGE 9½ YEARS
No. of cases	39	69
Cesarean sections	6 – 15.1%	9 – 15.0%
High forceps	2 – 5.1%	0
Mid forceps	9 – 23.0%	22 – 36.0%
Low forceps	6 – 15.1%	10 – 16.4%
Spontaneous	16 – 41.0%	20 – 32.6%
Average duration of labor	14 hr., 12 min.	16 hr., 24 min.
Infant mortality	5 – 12.5%	2 – 3.2%

There are two chief differences in these two groups: first, in the woman married five years or more before her first conception the labor was longer, and second, forceps were resorted to more frequently in the same class.

Weight of Babies.—The average weight of all babies, excluding prematures, was 7 pounds 8½ ounces, which would not corroborate the view that first babies born to older women were unusually large.

TABLE VI. LACERATIONS AND RESULTS

PERINEUM		CERVIX	
No laceration	46	Intact	49
Episiotomy	57	1° { stellate / unilateral / bilateral }	102
1° laceration	45	2° { stellate / unilateral / bilateral }	36
2° laceration	57	3° { stellate / unilateral / bilateral }	12
3° laceration	1		

Results:
fine 104
good 82 meaning no relaxation of pelvic floor at all.
moderate 20 meaning some degree of relaxation discoverable on examination but without symptoms.

Laceration or the necessity for episiotomy may be slightly more common in elderly primiparae than in young primiparae, though I believe the difference to be trifling. The results, however, were quite good.

Dry labor is mentioned as a complication of these labors. This cannot be considered very seriously when we find an average length of 11.6 hours for 82 cases. This is between three and four hours shorter than the general average of the entire series. The percentage of spontaneous deliveries in the dry labors was the same as that for all labors; there were fewer cesarean sections and more forceps deliveries.

TABLE VII. AVERAGE DURATION IN 82 DRY LABORS OF ELDERLY PRIMIPARAE

30-34		35-39	40-46	ALL AGES
11.1 hr.		11.8 hr.	13.8 hr.	11.6 hr.
DELIVERIES IN THESE DRY LABORS				
Spontaneous	15	11	3	29 — 35.5%
Low forceps	13	7	0	29 — 24.4%
Mid forceps	21	4	1	26 — 31.7%
High forceps	0	2	0	2 — 2.4%
Cesarean section	0	5	0	5 — 6.0%

Infant Mortality.—There were 12 deaths in 237 cases, or 5 per cent. This includes premature births. Five babies were dead before the beginning of labor (4 toxic cases and 1 placental infarction), 1 at six months, 1 at seven, 2 at eight months, and 1 at full term. These were macerated at birth. Of the remaining 7, 3 were delivered by high forceps, one was a breech delivery, one a placenta previa and finally eight months twins of a toxic mother with separation of the placenta.

SUMMARY

There still exists a more or less widespread feeling that childbearing in elderly primiparae is accompanied by a complicated pregnancy and a difficult labor, with an increased risk for the child.

There is a much higher percentage of elderly primiparae in private than in public hospital service.

The findings in this series of 234 private and 70 ward cases did not show more nausea and vomiting; did not show a higher percentage of twin pregnancies (1 to 101); did not show larger babies than the general normal ($7\frac{1}{2}$); did not show a higher incidence of abortions or premature labors; did not show more fibromyomas than in multiparae of the same age, and did not show a fetal mortality above the general average. Dry labors, if frequent, were shorter than those when the membranes ruptured later. The findings did not show an increase in the length of labor; as a matter of fact, the labors were shorter than in all primiparae by an appreciable length of time.

They did show a slight increase in toxemia of pregnancy, an increase in number of cases of funnel pelves, only a slight increase in unfavorable presentations and positions, an increase in the necessity for cesarean section, but a few abdominal deliveries were done with elderly

primiparity as a sole indication (the cases of contracted pelves would have demanded cesarean section had the woman been a young primipara).

There still is a small group of cases of first stage dystocia in which long labor will not dilate the cervix; many of these are due to primary inertia and only a few, in my opinion, to rigidity of the cervix. In some of these cases cesarean section should be done (6 cases in this series).

The usual dystocia seen in this series came after a satisfactory short first stage, with delay in the second stage due to inertia usually, but sometimes to a rigid pelvic floor. This explains the frequent resort to low or mid-low forceps extractions; the results as far as fetal mortality or condition of the pelvic floor was concerned were good. Elderly primiparae seldom have satisfactory lactation.

CONCLUSIONS

The management of labor in elderly primiparae is no different from that in young primiparae. A large proportion of these cases will permit of delivery through the pelvis, 89 per cent in this series. In only 2.9 per cent of these patients was the age of the patient the sole factor in deciding for abdominal section and, then, after a trial labor. Two measures; viz., analgesia during the first and second stage and the low cervical section facilitates a thorough trial labor after which it will be found that many patients, such as were formerly subjected to elective cesarean section, can be delivered by the pelvic route.

While pregnancy and labor in the woman having her first child after thirty carries with it an added risk to the mother and her baby, this hazard has been very much overestimated.

REFERENCES

(1) *Williams, J. Whitridge:* Obstetrics, D. Appleton & Co., New York, p. 240. (2) *DeLee, J. B.:* Principals and Practice of Obstetrics, ed. 4, W. B. Saunders Co., Philadelphia, p. 686. (3) *Berkeley and Bonney:* The Difficulties and Emergencies of Obstetric Practice, P. Blakiston's Son & Co., Philadelphia, p. 305. (4) *Spain, Kate C.:* Childbirth in Elderly Primiparae, Am. J. Obst. & Dis. Women 65: 421, 1912. (5) *Freeland, J. R.:* Labor in the Elderly Primipara, Am. J. Obst. & Dis. Women 71: 306, 1915. (6) *Schulze, Margaret:* Labor in the Elderly Primipara, Factors in Prognosis, J. A. M. A. 93: 824, 1929. (7) *Edgar, J. C.:* The Practice of Obstetrics, P. Blakiston's Son & Co., Philadelphia, p. 700.

26 SOUTH GOODMAN STREET.

THE TREATMENT OF HYPEREMESIS GRAVIDARUM

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(From the Toronto General Hospital, Service of Prof. W. B. Hendry.)

IN A RECENT review of the current literature DeLee[1] somewhat pessimistically asks, "What have we learned the past year regarding hyperemesis? Nothing! Our treatment is the same as it was, rest in bed, isolation, forced fluids and glucose intravenously." J. P. Greenhill[2] in a similar review states in reference to a claim made that injections of an artificially prepared antibody of human placental extract have cured a series of 40 cases, "the reviewer wishes he could meet such a miracle man. He must, however, content himself with the customary treatment of this condition, namely, isolation, rest in bed, forced fluids and glucose intravenously."

The unanimity illustrated here has at least the advantage to those treating hyperemesis gravidarum that the confusion of theories and nostrums advocated a decade ago has disappeared and whatever the present limitations of therapy, the now commonly established views mark a real advance.

The essential cause of this condition is as yet unknown. Although we cannot claim to have a specific form of treatment, much has been learned by intensive study of these cases and forms of treatment have been evolved which are for practical purposes satisfactory.

In this paper will be described the treatment of hyperemesis gravidarum as carried out at the Burnside Department, Toronto General Hospital in the Metabolic Ward with the cooperation of the Department of Pathological Chemistry under the direction of Professor V. J. Harding.

In our opinion, all cases of nausea and vomiting of pregnancy have a common underlying cause which may show itself in various phases. No satisfactory distinction can be made between toxic and neurotic vomiting. Any test which is devised to do so merely marks a stage in the progress of the disease at which a certain function or organ is deranged. These derangements appear earlier or later in the disease, depending on the individual and the direction in which the disturbances of metabolism progress. A case progressing slowly with almost compensating changes occurring *pari passu* will correspond to what some have called "neurotic." In others, progressing very rapidly, the gross degenerative changes appear quickly, the earlier stages escape notice, and the case is called toxic from the beginning. From this point of view, we have accounted for the widely variant types of the disease by noting the type of metabolic disturbance which is some-

times the dominant type in a given case. Close investigation of vomiting of pregnancy has shown that these types of metabolic disturbance are factors in the development of the disease and that upon their presence and the degree to which they are acting depend the clinical features and progress of the disease.

That a disturbance of the carbohydrate metabolism is a common feature is now accepted as a truism, although there may still be differences of opinion as to the interpretation of the obtained facts. The theory of carbohydrate deficiency as the primary cause of nausea and vomiting was first stated by Duncan and Harding in 1918[3] and published independently by Titus, Hoffman and Givens in 1920.[4] The publication of this work resulted in the rapid spread of the treatment by carbohydrate administration and the introduction in these cases of the intravenous method by Titus marked a great improvement in treatment.

It seemed an obvious conclusion to relate the condition of the glycogen depleted liver, the common occurrence of ketosis, and the periodicity of the symptoms with the time in pregnancy when there is a negative nitrogen balance, and when the carbohydrate storehouse, the placenta, is as yet not formed. These facts, if not completely substantiating the theory, at least pointed to starvation as a main factor in the production of some of the graver phenomena of hyperemesis and gave clear indication for the treatment of the condition by glucose. Underhill and Rand[5] had previously arrived at this conclusion from a study of the nitrogen partition of the urine. Early forms of treatment in our clinic consisted in schemes similar to those elaborated by Harding and Watson[6] in 1922. These in principle are still followed in the main, but, as our observations increased, it became apparent that by the use of the necessary fluids in glucose administration, we were treating a factor in addition to that of starvation.

It was generally found in a number of patients treated with intravenous glucose that the best control of treatment was the observation of the daily output of urine. Those patients responding to treatment by a large output of urine with a few exceptions markedly and coincidently improved clinically. The urinary output when the patients were first seen was taken as a helpful basis upon which to adjudge the severity of the condition and the necessity of bed treatment. Also the rapidity of the response to treatment; in other words, the time elapsing before a satisfactory diuresis was obtained, was found to bear a relation to prognosis. The patients in whom, after intensive treatment with fluids, the output and quality of the urine did not markedly improve, were the patients in whom abortion was thought necessary to prevent disaster. By diuresis we set an arbitrary standard that the twenty-four hour output of urine should have at least a volume of 1000 c.c. and a specific gravity of not higher than

1.010. Such a diuresis we expected to obtain promptly and where it was delayed longer than a week, we took that fact, along with the other clinical evidence, to justify therapeutic abortion. Thus, in addition to the use of glucose, the use of fluids became of paramount importance. This view was emphasized by Harding[7] in a communication in which it was pointed out that such results as had been attributed by Haden and Guffy[8] to the use of sodium chloride, and by Thalhimer[9] to the administration of insulin with glucose, were in his opinion due to and dependent on the use of fluids.

To investigate further the factor of dehydration, studies were undertaken of the serum proteins. The estimation of the changes in the N.P.N. and uric acid could be accounted for by dehydration but did not appear to have any significant interest. The serum proteins had been used as an index of hydremia in pregnancy[10] and might be expected to bear a relation to this condition in which dehydration played such a large part. From a study of 55 cases,[11] it was concluded that the general high level of serum protein indicated concentration brought about by the hyperemesis and reflected at the same time the condition of the tissues. It was noted that the majority of the patients showing a high serum protein value were those in whom intensive treatment yielded the promptest results. These were patients with a short preceding history, in which the dehydration had come on suddenly and acutely. With very occasional exceptions, the high value was found to be a good prognostic sign. On the other hand, when a low value was obtained, the condition had been usually established for some time and, when clinical signs of dehydration were present, the prognosis was serious.

Our interpretation was that,[11] "In vomiting of pregnancy the partial or complete abstention of food, coupled with the loss of fluid by vomiting cause an acute anhydremia. The concentration of the serum proteins rises. If at this stage fluids are freely supplied by the use of glucose in saline either intravenously or rectally or by hypodermoclysis, the blood concentration is restored to normal. If isolation and rest in bed are sufficient to check the neurotic element present in these patients, then fluids by mouth are all that is necessary. If, however, the acute dehydration is allowed to go unchecked, destruction of the serum proteins takes place. The value falls to nearer normal, or it may even become subnormal. In these cases, simple replacement of lost fluid will not suffice. There must also be a regeneration of a serum protein before complete recovery is possible. In these cases may perhaps be seen the therapeutic value of larger amounts of glucose in saving N loss to the body and thus aiding protein regeneration. In extreme cases the employment of transfusion would be the logically indicated treatment."

Some five of our patients with a high initial serum protein value, fell to a subnormal level and finally gave normal figures on discharge. This is explained as evidence of the destruction of serum proteins during the course of the dehydration when the anhydremia is overcome; a regeneration of the serum proteins is in these patients necessary and explains the slow recovery of this type of patient. It has also been noted that these latter are subject to relapse.

In treating this factor of dehydration, we found it necessary to use increased amounts of fluid and our earlier view outlined above that failure to produce prompt diuresis was an indication for therapeutic abortion, we were forced to adopt as proof that the quantities of fluid administered were insufficient. In the first years the amounts were from 1000 to 1500 c.c. in twenty-four hours. During the past three years, 3000 c.c. of 10 per cent glucose in normal saline have been given daily in addition to whatever the patient could take by mouth. The rate of administration was governed by the dictum of Wilder and Sansum,[12] in accordance with which the flow was regulated at 600 c.c. of 10 per cent glucose per hour. This would at first sight appear to subject the patient to the hypoglycemic reactions described by Thalhimer,[13] and be in disagreement with the therapeutic limits established by Titus and his coworkers.[14] The increase in the amount of glucose used in our ward was, however, a gradual one and our avoidance of reaction, of which we have been quite free since the early days when the amounts of glucose were one-third or less, we can attribute to greater care in the preparation of glucose, the use of glucose always in normal saline solution, and more individual regulation of the temperature of the fluid administered. With the necessary details of the preparation all are familiar, but an essential difference between the conditions under which hypoglycemic reactions are reported and our administration is perhaps the use of a normal saline medium. As our patients had no reactions, we made but few blood-sugar estimations but these were invariably within normal limits. The other points of technic stressed here are that the rate was controlled by a side burette after the method described to us by Thalhimer and the use of a thermometer within a glass tube incorporated in the tubing at the vein. The temperature at which the fluid was given could be varied according to the individual, but on an average the thermometer was kept at a reading of from 100° F. to 105° F., permitting the fluid to enter the vein at approximately blood heat or slightly over. With considerable individual variations, it was found that higher temperatures made the patient complain of flushing, headache, and general discomfort and lower temperatures produced feelings of chilliness. That some of our early reactions were due to too low temperatures became evident on noting the temperature at which we now find it necessary to keep the reservoir flask. Care from the nurse is necessary to maintain an even

heat at the vein, and a simple method is the use of hot water bottles along the course of the tubes.

The 3000 c.c. are given in five hours and this technic has been employed without reactions in the last three years as a routine. This amount is given daily and continued until the patient is able to take sufficient water by mouth to maintain a large urinary output. In the great majority of our patients, this treatment, combined with such sedatives as heroin, morphia, and bromides, with attention to the bowel elimination, and isolation, has been effective.

Mouth feeding was begun as soon as possible with light foods, the choice of which we do not regard as of as much consequence as the way in which the trays are made attractive. The length of time the patient is allowed to convalesce under hospital conditions is important, as patients discharged too early tend to have very serious and obstinate relapses.

In the few patients resisting this treatment, where we have sometimes found it necessary to do therapeutic abortion, we believe we have found direct evidence of a third factor, liver degeneration, in addition to that of starvation and dehydration, and that this factor demands an addition to our usual treatment. This view was set forth in 1929 by Harding and his colleagues.[15] In these obstinate cases not recovering on the usual administration of intravenous glucose with the usual large amount of fluids, there is always a persistent urobilinuria and this can be interpreted as evidence of persisting liver damage. In 80 per cent of our cases urobilinuria was present at the beginning. In the great majority of these, the usual treatment is effective in causing the disappearance of this sign of liver derangement, which in these cases is probably slight. In these there is no icterus and only slight increased van den Bergh reactions. These cases respond satisfactorily to treatment, hunger returns, and recovery is progressive.

It is in the few who respond slowly or not at all that, in spite of the correction of the dehydration, urobilinuria persists. With our interpretation of this as a gravely disordered liver function, we attempted to correct it by feeding a much higher number of calories than could be administered intravenously. The method used was the duodenal tube and feedings of 3 oz. of skimmed milk and 3 oz. of 10 per cent glucose were given every two hours throughout the twenty-four. This enables one to give 780 additional calories to the patient as well as 2000 c.c. more water. The results in the few patients in whom this additional treatment is indicated have been so satisfactory as to convince us of the value of the urobilinuria as an urgent sign for higher caloric feeding and of the success of this measure adopted to meet the indication.

A practical point of some importance is that in the absence of adequate laboratory facilities, urobilinuria may be assumed to be present

when the urine has a characteristic orange red color. When the color persists in the urine in spite of adequate treatment, it may be taken as an indication of serious and progressive liver damage.

A fourth factor demanding treatment is the neurotic. The part this plays in an individual case varies considerably but all are aware of its presence to a greater or less degree. It has been seen in a striking form in our special ward of four beds in the aggravation of the condition of the other three when one patient suffers a marked relapse of symptoms. The obvious solution in public ward practice is to be able to isolate each case of hyperemesis. This requires special organization, as these cases cannot be as satisfactorily handled under ordinary ward conditions. A substantial saving of fetal and maternal lives will be made when our public institutions provide facilities for the special nursing and complete isolation of each case of hyperemesis, even for indigent patients.

These, then, are the factors demanding treatment and our experience would lead us in grouping the cases according to these principles:

1. Those patients in whom dehydration has as yet produced few changes and in whom with isolation, rest, and the administration of fluids and food by mouth the cure is easily effected.

2. The group in which dehydration is more acute (usually with a high serum protein value) but in which after repeated daily intravenous injections of 3000 c.c. of 10 per cent glucose given as previously outlined, the clinical recovery parallels the diuresis.

3. The comparatively few patients in whom in spite of such treatment, and the procuring of a satisfactory diuresis, there is little or no clinical improvement. These invariably show a persisting urobilinuria and can be subdivided into (a) patients progressing slowly but amenable to treatment by duodenal tube as already outlined, (b) the very few patients in whom downward progress, in spite of all treatment, can be stopped only by therapeutic abortion.

It is certainly within the scope of this review to deal, if only briefly, with prophylaxis as a logical development from the view that the inherent cause of the mild types of vomiting and the severest forms is the same. We regard these factors outlined above as applicable to the treatment of even the mildest forms of disturbance in early pregnancy, before the patient has as yet failed to compensate the changes threatening from starvation and dehydration. The prophylaxis of hyperemesis is the treatment of all early pregnant patients. When such a patient is not remaining acetone-free, is not maintaining a normal water balance as shown by a low daily output of urine with a high specific gravity, or is rapidly losing weight and strength, she should no longer be treated as an ambulant patient but must be safeguarded by more intensive treatment in bed.

The patient with early symptoms of nausea and vomiting, however, who is showing none of these indications of a losing equilibrium should be put on a routine which takes into account the four factors previously mentioned. It is unnecessary here to list in detail the instructions that such a patient should receive, but some systematic advice should be given her which takes into account that potentially she is threatened with a condition which may be averted by the regular frequent administration of food, of increased fluids, the taking of periodic rest, as well as other obvious matters of common hygiene.

CONCLUSIONS

1. The four factors, starvation, dehydration, hepatic derangement, and neurosis demand treatment by:

    a. Rest in bed with isolation

    b. Sedatives

    c. Intravenous 10 per cent glucose in normal saline in amounts up to 3000 c.c. daily until the urine is increased to at least a liter

    d. The use of larger amounts of carbohydrate and protein by duodenal tube in certain cases

The first two are used to overcome the neurosis, the third the dehydration, and the fourth, the hepatic derangement.

2. The same principles indicate the prophylactic measures which should be used in the treatment of early mild nausea and vomiting.

REFERENCES

(1) *DeLee:* Obstetrics and Gynaecology, British Medical Series, 1929, p. 103. (2) *Greenhill, J. P.:* Am. J. Obst. & Gynec. 19: 606, 1930. (3) *Duncan, J. W., and Harding, V. J.:* Canad. M. A. J. 7: 1057, 1918. (4) *Titus, P., Hoffman and Givens, M. H.:* J. A. M. A. 74: 777, 1920. (5) *Underhill, P. F., and Rand, R. F.:* Arch. Int. Med. 5: 61, 1910. (6) *Harding, V. J., and Watson, B. P.:* Lancet, London 2: 649, 1922. (7) *Harding, V. J., and VanWyck, H. B.:* Am. J. Obst. & Gynec. 11: 1, 1926. (8) *Haden, R. L., and Guffey, D. C.:* Am. J. Obst. & Gynec. 8: 486, 1924. (9) *Thalhimer, W.:* Am. J. Obst. & Gynec. 9: 673, 1925. (10) *Plass, E. D., and Bogert, L. J.:* Bull. Johns Hopkins Hosp. 35: 361, 1924. (11) *Harding, V. J., and VanWyck, H. B.:* J. Obst. & Gynaec. Brit. Emp. 36: No. 3, 1929. (12) *Wilder, R. M., and Sansum, W. W.:* Arch. Int. Med. 19: 311, February, 1917. (13) *Thalhimer, William, Raine, F., Perry, M. C., and Battles, Jane:* J. A. M. A. 87: 391, August 7, 1926. (14) *Titus, Paul, and Lightbody, H. D.:* Am. J. Obst. & Gynec. 18: 208, 1929. (15) *Harding, V. J., and VanWyck, H. B.:* J. Obst. & Gynaec. Brit. Emp. 36: No. 3, 1929.

VENOCLYSIS, THE CONTINUOUS INTRAVENOUS ADMINISTRATION OF GLUCOSE

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THIS discussion is in the nature of a supplementary report of further work described in an article by the author, published in Vol. XLII, 1929, of the Transactions of this Society, entitled "Glucose in the Treatment of Pregnancy."

In the consideration of any therapeutic agent, the principal factors to be determined are: (1) Indications for the use of that particular substance in a given disturbance; (2) Dosage; (3) Methods of administration. The presentation of this paper concerns chiefly the last named factor, namely, a practical method of supplying glucose in solution to a patient in quantities sufficient to maintain adequate nourishment, supply sufficient fluids for body needs and deriving certain therapeutic benefits therefrom.

The value of glucose and indications for its use as a therapeutic agent, especially in the toxemias of pregnancy, has been so ably shown by various investigators, that we will not discuss it here. The dosage has been determined by Titus,[1] Woodyatt, Sansum[2] and others, and from our experience, has been reduced to a practical working basis.

The various methods of administration of glucose are: by mouth, rectally, subcutaneously, intraperitoneally and intravenously. When given directly into the circulation it may be administered by the dosage method (given quantities administered at varying intervals, as employed by Titus and others, or by a continuous flow over a prolonged period of time, as employed by Matas, Hendan, Warthen and others. Matas[3] was first to use this method, and called it the "continuous intravenous drip." Hendon,[4] closely following Matas in his investigations along this line, called the method "venoclysis," and to him belongs the credit of first devising and reporting a technic and apparatus making the system capable of practical use. We have employed his technic in our work.

The essential features of the apparatus used are two thermos bottles of 1000 c.c. capacity each, suspended in a wire frame and attached to a Y-tube, which is in turn connected to a Murphy drip tube; from this a single rubber tube leads to a gold-plated silver cannula. This cannula is inserted through a phlebotomy opening into a vein just above the bend in the elbow. The vein is ligated distal to the insertion, and a ligature of umbilical tape is passed around the cannula in the vein, held in situ by a shoulder on the cannula. The wound is closed and a sterile dressing applied. The rubber tubing is fixed to the arm by strips of

adhesive, permitting the patient to move the arm at will during the administration. The use of two thermos bottles permits the employment of one while the other is being filled. The thermos feature keeps the solution at a constant temperature.

The hole in the Murphy drip tube is covered with adhesive, aiding materially in the regularity of the flow from the reservoir. Other veins may be used, but we have found that if the insertion is made sufficiently far above the elbow to be proximal to the tributary radicals of the vein employed, there is no back-flow of blood into the cannula and the flow may be temporarily discontinued and resumed without clot formation.

The greatest disadvantage to this method is the necessity for cutting down on the vessel, with a resultant scar. We can keep the flow going satisfactorily for eight to twelve hours by piercing the vein with a large needle, but after a time the lumen becomes occluded, and another puncture must be made. If longer continued use is desired, a phlebotomy must be done and a cannula employed.

After a few days in some cases the arm above the insertion becomes congested and reddened, causing the patient some discomfort. This can be largely relieved by an ice-bag applied to the congested area.

Then the performance of a phlebotomy is a more complicated procedure than the mere piercing of a vessel with a needle.

The chief advantage in the use of the cannula is that with one insertion into the vein a continuous flow can be given over quite a number of days without further disturbing the patient. The principle advantage of a prolonged continuous flow over the ''dosage'' method is that not only can much larger quantities of nourishment and fluids be given a patient in each twenty-four-hour period, but because the flow is continuous there is no danger of any sudden overload upon the circulation or assimilative process of the body.

In most of our cases the apparatus is set to deliver forty drops of 10 per cent glucose per minute. This gives the patient 400 grams (0.8 pounds) of sugar and 4000 c.c. (one gallon) of fluid per day. In order to accomplish this with intermittent injections, four injections of 1000 c.c. each at six-hour intervals, or eight injections of 500 c.c. each at three-hour periods, would be required.

Other substances can be administered by this same method. Saline solution or Ringer's solution can be used alone or in combination. Such drugs as sodium luminal, sodium amytol and digifolin, adrenalin or caffein can be injected into the solution through the small hole in the Murphy drip tube. Citrated blood may be given with the glucose.

Dr. H. J. Warthen[5] reports in July, 1930, issue of the *International Surgical Digest,* extensive work done with this method in the Surgical Department of Johns Hopkins. His technic is very similar to that of Hendon, and his observations correspond very closely to ours. He cites

one of his cases in whom "the solution was given continuously for eighteen days, with the exception of three short intervals during the removal and reinsertion of the cannula into a different vein." Fifty-four thousand c.c. of 5 per cent dextrose were given during this time. He uses veins about the ankle as well as in the arm.

The chief use for venoclysis is in cases where the giving of food, water or drugs by mouth is impracticable. In obstetrics, hyperemesis gravidarum with dehydration offers the most outstanding indication for this method of treatment. Hendon's cases and those of the author, treated for hyperemesis by this method, are 15 in number. Most of these patients had received glucose intravenously by the intermittent method, without apparent benefit. In each case the hyperemesis was of the severe type of considerable duration. All showed marked improvement, and most of them were completely relieved by the end of the fifth day. None of them died of hyperemesis. One died later in pregnancy of a perforated gastric ulcer and one had a therapeutic abortion done after she left our care, but her general condition had been so improved as to make the operation practicable.

Two of the above patients have again become pregnant and have passed the third month without any vomiting. Whether this is coincidence, or due to the regenerating influence of the glucose, we cannot say. In both cases, however, they have each had several pregnancies, and in all others the vomiting had been severe. We have found in treating hyperemesis by this system that nausea and vomiting are more quickly relieved by adding sodium luminol or sodium amytal to the glucose.

In the primary toxemia of early pregnancy, that is, a severe vomiting due directly to the pregnancy, glucose has proven in our hands a most valuable remedy, acting practically as a specific. In the secondary toxemias, where the vomiting is due to some preexisting pathology such as nephritis, gastric ulcer, gall bladder infections, etc., glucose treatment aids materially in supporting the patient, but seems to have very little effect in controlling the vomiting.

It is well understood that dextrose does not become available for use in the body until it has undergone certain biochemical changes. It is stored in the liver as glycogen. One of the chief agents said to produce these changes is a substance developed by the activity of voluntary muscles. When the patient is at rest, the conversion of the vegetable dextrose into animal glycogen proceeds much more slowly. The dextrose remains, for a longer period of time, therefore, as a foreign substance. In the intravenous administration of glucose this factor should be borne in mind.

In our investigations we have attempted to ascertain the relative effect on blood sugar of the slow, continuous administration in comparison with the more rapid, intermittent method. We took two series of cases

for this study, taking blood-sugar readings at half-hour intervals, the
first reading being taken just before the administration was begun, secur-
ing a specimen each half-hour until six readings were obtained. In one
series the glucose was given by the continuous method, and in the
other series 500 c.c. of 20 per cent solution was administered over
a period of about forty-five minutes. Table I shows all the readings
obtained in these two series. While the number of cases investigated
is not large, yet a very striking uniformity of results will be noted;
so much so indeed, that we felt it would not be amiss, for the purpose
of graphic charting, to total each column of a given half-hour period
for the entire series and graph the averages. It will be seen that the
initial blood-sugar rise in the venoclysis cases averaged 69 mg. per
100 c.c., while in the cases given glucose by the dosage method, the
average initial rise was 438 mg.

TABLE I

NAME	MG. BLOOD SUGAR BEFORE INJECTION BEGAN	ONE-HALF HOUR LATER	ONE HOUR LATER	ONE AND ONE-HALF HOURS LATER	TWO HOURS LATER	TWO AND ONE-HALF HOURS LATER
VARIATIONS IN BLOOD SUGAR DURING CONTINUOUS GLUCOSE ADMINISTRATION						
L. P.	135	204	196	169	181	200
N. G.	111	135	133	130	111	117
N. N.	102	160	153	128	115	114
R. T.	142	273	364	250	235	454
S. T.	133	166	125	158	101	97
B. W.	123	243	- 151	126	111	117
Averages	124	193	190	160	142	183
VARIATIONS IN BLOOD SUGAR DURING INTERMITTENT GLUCOSE ADMINISTRATION						
E. G.	97	400	222	181	133	116
M. S.	160	800	614	362	285	234
L. R.	117	666	250	142	111	111
C. M.	142	666	500	370	344	224
A. C.	98	266	142	98	95	95
Averages	122	560	345	230	193	156

Table II shows the graphic plotting of the average variations of
blood sugar during the first three hours of administration by the two
methods.

It is reasonable to suppose that a similar variation occurs in the
volume of the blood-vascular system. From a mechanical standpoint,
therefore, as well as from a biochemical, it would be apparent that
there is much less danger of overloading the cardiovascular mechanism
as well as the assimilative processes of the body when glucose is given
by the slow, continuous method.

Insulin was not used in any of these cases, and it will be noted that
in none of them was there any tendency to hyperinsulinism.

In subsequent blood-sugar readings taken at varying intervals the
sugar level remained very near that of the last reading in this table.

Glycosuria is rarely encountered in any of our cases, and when it appears can be overcome by reducing the concentration of the solution administered.

Warthen[5] gives 5 per cent glucose in normal saline. He says, "With patients showing evidence of nephritis, normal salt solution is administered with caution and is discontinued as soon as possible for fear that salt retention may follow, with edema and possible pulmonary complications."

From a clinical standpoint, we have had fewer reactions with venoclysis than with the intermittent method.

Hendon has used his venoclysis method in several hundred cases, and his results have demonstrated that the procedure has a distinct

TABLE II

Mgs. Blood-sugar per 100 c.c.	Before injection began	One-half hour after injection began	One-hour after	One and one-half hours after	Two hour after	Two and one-half hours after	

------ Indicates blood-sugar variations with intermittent administration.
———— Indicates blood-sugar variations with continuous administration.
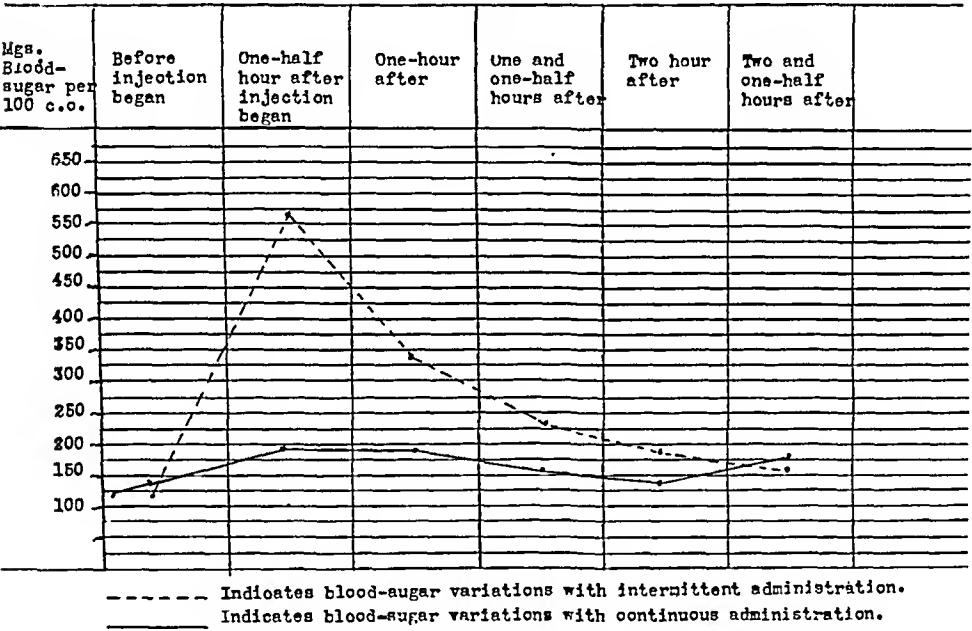
clinical value. His observations cover a period of about five years. The author is indebted to Dr. Hendon for the privilege of observing a large number of these cases, and it was the striking clinical results obtained that prompted us to undertake an investigation of the biochemical phenomena encountered when this system was used, and to ascertain its clinical value in obstetric practice. We wish to acknowledge our gratitude to the Research Laboratory of the Louisville City Hospital, under the direction of Dr. John Walker Moore, and to the resident staff of the Obstetrical Department of this institution for their valuable aid in making these investigations.

We might further add that the work of Hendon has brought out some very interesting clinical facts.[6] It has been found, for instance, that a far greater amount of glucose could be given, and for a much longer period of time than was formerly supposed. Hendon has maintained

adequate nourishment and a sufficient supply of fluid for as long as fifteen days without anything by mouth or rectum. Dr. Frank Striekler reports a ease maintained thus for twenty-one days.

In none of the eases so treated has there been any notieeable ill effeets due to a laek of protein supply. The glueose has apparently been adequate to maintain a well-balanced metabolism. The individuals so treated have all been very siek, and the almost universal rule has been an inerease in strength and energy.

None of Hendon's patients have showed any tendency to hyperinsulin disturbances. Much apprehension has been felt in the past lest the administration of large quantities of sugar overstimulate the produetion of insulin with resultant shoek. But it is eertainly apparent that with the slow continuous method, at least, such fears are groundless.

No ease among the hundreds so treated has showed any signs of thrombus or embolus disturbance. Any given vein so used will beeome oeeluded in from five to seven days, but the ligature distal to the insertion seems to prevent elot particles from getting into the eireulation.

We have found that in the average ease 200 c.c. per hour is the maximum rate of administration. If given faster, evidences of overloading are often noted.

This discussion has primarily to do with the use of the continuous administration of glueose in hyperemesis gravidarum, but this procedure has been used with marked suecess in other disturbances incident to or complieating pregnaney, sueh as puerperal sepsis, anemia from hemorrhage, peptic uleer, peritonitis, biliary tract disease, and other conditions where feeding by mouth is inadequate or impractieable.

While we do not contend that every case of hyperemesis should be treated by the continuous drip method, yet from our observations we do feel that many eases ean be suecessfully treated thereby where less radical measures fail. If future experienee with this method continues to show the same degree of effectiveness in the treatment of severe hyperemesis as we have already found, it will take its place as one of the most valuable weapons available in combating this dread disease.

SUMMARY

1. "Venoclysis" is a term employed by Hendon to denote the administration of fluids into the blood stream through a eannula anehored in a vein, the solution flowing continuously and slowly over a protraeted period of time.

2. A technie has been devised whereby a eontinuous flow may be used, rendering the procedure safe, practieable and adequate for supplying nourishment, fluids and therapeutic agents.

3. By this method, glucose may be given, eonserving the metabolie or blood-volume balance, maintaining the normal ratio between delivery and distribution.

4. Biochemic findings show this to be the ideal method of giving glucose where considerable quantities are to be given over a long period.

5. Clinically, this method of administration has proved of marked value in the severe type of hyperemesis gravidarum with dehydration, as well as other obstetric complications where feeding by mouth or rectum is for any reason inadequate or impracticable.

REFERENCES

(1) *Titus and Givens:* J. A. M. A. 78: 92, 1922. (2) *Woodyatt, Sansum, and Wilder:* J. A. M. A. 65: 2067, 1915. (3) *Matas:* Ann. Surg. 79: 643, 1924. (4) *Hendon:* South. Surg. Assn. 37: 185, 191, 1924. (5) *Warthen:* Int. Surg. Digest. 10: 1, July, 1930. (6) *Hendon:* Ann. Surg. 91: 753, 1930; Kentucky M. J. 27: 202, 1929; S. Clin. North America 10: 945, 1930.

CHORIOMAS

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EIGHT cases of malignant choriomas and three cases of benign choriomas were observed in our clinic within a relatively short time. They were referred either on account of persistent uterine bleeding simulating a malignant disease in some instances or for prophylactic radiation therapy to prevent recurrence after preceding surgical removal. The pathologic, diagnostic, and therapeutic observations were of unusual interest and are herewith recorded.

Choriomas are of infrequent occurrence. Szathmary collected from 53,000 consecutive pregnancies 39 cases of hydatid mole, i.e., one mole in 1690 pregnant uteri, and 11 cases of malignant chorionepithelioma, or one malignant chorioma in 4900 pregnant uteri. Five cases of chorionepithelioma followed a preceding mole, 15.1 per cent of the 32 moles.

Tumors of the chorion develop from the chorionic epithelium which is derived from the trophoblast. As soon as the epithelial cells acquire the faculty to destroy maternal tissue then the ovum or blastocyst attains enisting or invading powers and at this time imbeds itself wherever it happens to be. The entire process of implantation and the subsequent formation of the placenta is termed placentation.

The study of chorionic tumors requires an intimate knowledge of the processes of nidation and placentation. Several stages in these processes verge closely on pathologic malignant states but, of course, are entirely of a physiologic nature. By a process of histolysis the ovum or blastocyst excavates an opening in the lining of the most adjacent maternal tissue and sinks beneath the tissue surface, usually the decidua vera of the uterine body. The lytic power is ascribed to the Langhans cells and the resorptive power is attributed to the syncytial or plasmodial cells

of the chorionic villi according to Grosser. The port of entry in the decidua becomes closed over the ovum by the formation of a plug composed of chorionic cells, decidual cells and fibrinous material. Thus the nidation of the ovum in the blastocyst stage is completed and the process of attachment to the maternal tissue begins.

The degree of union of ovum and maternal tissue may be epithelio-chorionic, syndesmochorionic, endotheliochorionic, or hemochorionic. The latter form requires the most extensive destruction and invasion of the maternal tissue by the chorionic cells and is the type occurring in the human subject. The lytic and invasive activities of the chorionic cells end when a direct contact between the maternal blood and the blastocyst has been established.

Chorionic giant cells permeate the uterine wall throughout pregnancy and if placental tissue has been left behind at labor, also during the puerperium until every vestige of the ovum has been expelled or removed. This finding according to R. Meyer is analogous to other benign heterotopies without destructive or solvent capacities such as adenomyosis or endometriosis. The occurrence is especially pronounced in uteri weakened by other pathologic processes.

The histologic structure of the chorionic villus and the tumors of the chorion will not be described as a knowledge of these conditions is presumed. Proliferation of the chorionic epithelium, destruction and invasion of the maternal tissues are the physiologic processes of the trophoblast akin to the pathologic but similar processes seen in choriomas.

Tumors of the chorion may be benign or malignant. The benign growths are the simple hydatid mole and the invasive hydatid mole. The latter has been termed chorionadenoma destruens by Ewing. The malignant tumors comprise the typical malignant chorionepithelioma and the atypical chorionepithelioma malignum.

The simple and invasive hydatid moles possess the relative inability of the chorionic epithelium to rid itself from the connective tissue core of the villus. The persistence of the mesodermic tissue in the chorionic proliferation constitutes a reliable index of benignancy. Durante and Ewing consider the villi to be glands in every essential aspect, both anatomic and physiologic. A tumor which reproduces in an orderly manner the structure of a glandular organ is by common definition an adenoma. The mole may invade the placenta either partially or totally. Total degeneration of the placenta causes death of the embryo. The mole is an epithelial proliferation. The hydropic swelling of the chorionic cells causes the formation of vesicles. The edematous permeation of the stroma is generally considered a regressive process.

The invasive mole is of the same structure as the simple mole but characterized by a deep penetration of the villi into the lumen of the uterine vessels. The epithelium rarely breaks through the vessel wall.

Similar observations may be noted in ectopic implantations of the ovum and in placenta accreta. It is not improbable that the deeply intravascular position of the villi may favor a malignant degeneration, as prolonged viability of the chorionic epithelial cells is assured by the constant supply of fresh blood. However, intravenous invasion per se is not an evidence of malignancy. The villi lie entirely in the vessel lumen.

Marchand has divided the malignant choriomas into typical malignant chorionepithelioma and atypical chorionepithelioma. The malignant proliferation of the chorionic epithelium is a continuation or reactivation of the trophoblast at the stage of implantation. The typical malignant chorionepithelioma, the choriocarcinoma of Ewing, is composed of compact masses of Langhans cells, syncytium and intramural chorionic cells. The plasmodal cells are seen in the peripheral zone of the cell mass, while the intramural cells form the vanguard. The villous stroma does not participate in the tumor growth. It is missing. According to R. Meyer the ratio of Langhans cells to syncytial cells to intramural cells in typical chorionepitheliomas should be the same as found in the villi and uterine wall during the implantation period of the first and second months. Should the typical ratio be changed in favor of either the Langhans, the syncytial or the intramural cells, then the chorionepithelioma is atypical.

Ewing described cases formed almost entirely of syncytial cells and termed them syncytioma malignum. They number at the most about 5 per cent of the total number of malignant choriomas. He states that they are relatively benign. The presence of Langhans cells in predominant numbers constitutes the most malignant type of choriomas.

At times a large increase in the number of intramural cells in the absence of any intrauterine growth has been found. The cells are of the syncytial or giant cell type. The hyperplasia has been called by Ewing syncytial endometritis. R. Meyer and others have described similar findings. The significance of the syncytial hyperplasia is that simple curettage will bring about a complete healing. Should bleeding recur then radium may be inserted intrauterine. This has been successfully done by Rosenzweig.

The conclusion may be drawn that, whenever malignant qualifications develop in the chorionic epithelium, as anaplasia, atypia, invasive and destructive tendencies and capacity for metastasation, then the benign chorionadenoma ends, and with the disappearance of the central connective tissue core the chorionepithelioma begins. Hence the persistence of the mesodermic tissue in the chorionic invasion constitutes a reliable index of relative benignity. Choriomas composed of only one type of chorionic epithelium do not exist.

It is evident that histologic examinations should be done on all tissues expelled or obtained by the curette after abortions, labors, and expul-

sion of a supposed mole. One should also remember that negative histologic findings do not exclude the presence of choriomas as they may grow intramurally.

When performing a diagnostic curettage it would be desirable to excavate a piece of tissue from the uterine wall to enable one to study the fetal and maternal relation. Vaginal hysterotomy should be done, if curettage is negative and the possibility of the existence of choriomas is present indicated by the history and symptoms in the case.

Spontaneous regression of the primary growth even after the formation of metastases, and regression of metastases after removal of the primary growth have been reported by many writers. Ewing states that regression is seen only in benign choriomas, malignant syncytioma and syncytial endometritis and never in a choriocarcinoma containing a predominence of Langhans cells. If death occurs in cases with benign growths it results either from severe and continued loss of blood or secondary infection.

No discussion of the symptoms and signs and differential diagnosis is needed here. If the rule is followed that the underlying disease in uterine hemorrhages must be immediately diagnosed, and that diagnostic curettage must be made if clinical measures fail, then failures in diagnosis will be few.

Newer procedures in diagnosis are the roentgen rays and the biologic pregnancy reaction of Zondek and Aschheim.

If pregnancy is suspected in a bleeding uterus the size of a four to five months' pregnancy an x-ray picture should be taken. If irregularities in the uterine wall or abnormal shadows are found with or without a fetus, the assumption is justified that a chorioma probably exists. In a recent case of a suspected uterine tumor, the x-ray revealed a fetus and an irregularity in the right uterine horn. The fetus and intact normal secundines were expelled spontaneously within twelve hours. Involution did not occur. Examination on the tenth day postpartum revealed an open cervical canal, the examining finger felt a soft mass in the uterine cavity, biopsy and frozen section examination revealed a typical malignant chorionepithelioma. A hysterectomy was done immediately.

Ponzian recommended hysterography after the intrauterine injection of iodized oil to diagnose choriomas. The danger of forcing chorionic tissue through the uterine tube or a weakened uterine wall contraindicates the procedure.

Aschheim states that the urine of patients with hydatid mole or chorionepithelioma gives a pregnancy reaction in mice about ten times stronger than that obtained from women in the eighth pregnancy week. Reports published by Fels and others in the literature confirm these findings. A valuable test is thereby given enabling one to confirm a

suspected diagnosis of chorioma or a recurrence after a surgically removed mole or chorionepithelioma.

The treatment of benign choriomas if bleeding continues after the expulsion of the mole is speedy removal of the uterine contents with the curette and microscopic examination of all tissues removed.

The treatment of the malignant choriomas is a radical panhysterectomy if a histologic diagnosis has been made. Even if metastases have formed hysterectomy should be done as regression of metastases after operation has been repeatedly observed in choriomas.

In late years quite a number of cases have been reported in the literature which were successfully subjected to radiation. The epithelial cells of choriomas are of a highly embryonic and anaplastic character and should be very radiosensitive. Therefore radiation therapy should be used in cases offering a poor surgical risk or after operation to prevent recurrences.

In 1918 a patient in the 16th week of pregnancy entered St. Mary's Hospital on account of severe hemorrhages from the right kidney. A diagnosis of a malignant tumor of unknown type was made. On account of the anemic condition of the patient and the pregnancy, the kidney was treated with filtered x-rays and the hemorrhages ceased. About a month later the uterine contents were spontaneously expelled. Microscopic and macroscopic examination revealed a typical malignant chorionepithelioma. Radium was inserted intrauterine and heavy filtered x-rays were applied through suprapubic and sacral fields. The patient is well at the present writing.

A second case of malignant chorionepithelioma was admitted for radiation therapy about two and one-half years ago. The contraindications to operation were pronounced anemia and extensive invasion of vagina and left parametrium. Radium and x-ray treatments caused an anatomic healing. The patient was well two and one-half years after treatment.

Similar observations have been reported by Naujoks, Gordon, Szathmary, Loebe, Klein, and others,

From the records appended it is seen: (1) that two cases of malignant choriomas treated with radium and x-rays alone are well thirteen and two and one-half years respectively; (2) that three cases were treated with hysterectomy followed by radium and x-rays; one case is well two and one-fourth years, one case one and three-fourths years and one case three-fourths year; (3) that two cases were subjected to hysterectomy alone; one patient died from an infection, the other patient is well nine months; and (4) that one chorionepithelioma recurring after operation with metastases in pelvis and brain was unsuccessfully treated with x-rays.

It is an axiom: if a malignant chorioma does not recur within six months, the patient probably will remain well, and if it does not recur within one year after cessation of treatment the patient may be considered cured.

SUMMARY

1. Tumors of the chorion may be benign or malignant. The benign growths comprise the simple hydatid mole or chorioma simplex and the invasive hydatid mole of chorioma accreta. The malignant group includes the typical malignant chorionepithelioma and the atypical malignant chorionepithelioma.

2. The persistence of the chorionic connective tissue of the villi in the chorionic epithelial cell proliferation is characteristic of the benign choriomas. Absence of the connective tissue with anaplasia and atypia of the chorionic epithelium, and invasion, destruction and formation of metastases in the maternal tissues constitutes a malignant chorioma.

3. Roentgen-ray examinations and the Aschheim-Zondek pregnancy reaction may render valuable aid in the diagnosis of obscure cases of choriomas or suspected recurrences.

4. Benign choriomas may become detached from the maternal tissue and borne by the uterus. If retention and reactivation of remnants occur as indicated by recurrent uterine bleeding and corroborated by the Aschheim-Zondek test then curettage should be done.

5. Malignant choriomas must be subjected to radical panhysterectomy as soon as the clinical diagnosis has been corroborated by a histologic examination. The favorable results obtained with radiation therapy without the use of surgical measures in two choriocarcinomas permit the conclusion that hysterectomy followed by radiation therapy may lessen the number of recurrences in the malignant choriomas. Apparently the good end-results obtained in this series of cases with a combined treatment of surgery and radiation prove the soundness of this deduction.

6. Bleeding from a uterus, particularly a pregnant uterus, is always a serious accident. All tissues expelled from such a uterus should be subjected to competent microscopic examination which is essential in arriving at a correct diagnosis and applying the indicated treatment.

CASE REPORTS

CASE 1.—Mrs. McK., aged thirty-two, gravida 6 and para v, was admitted to St. Mary's Hospital September 21, 1918. She had had hemorrhages from the right kidney for three months previously. A diagnosis of malignant tumor of the right kidney was made from the pyelogram. Due to the pregnancy it was treated with deep x-ray therapy, which arrested the bleeding.

On September 23, 1918, a fetus with membranes intact was expelled spontaneously. Microscopic examination revealed a typical malignant chorionepithelioma. The kidney tumor was then considered a metastasis. Radiation therapy was advised and 2040 mg. element hours of radium filtered with 2.0 mm. brass were given intrauterine and a 150 per cent erythema dose of x-rays was applied to the center of the pelvis through suprapubic and sacral fields. The patient has remained well.

CASE 2.—Mrs. E. S., aged thirty-two, gravida 1, para i, was seen in consultation April 28, 1926. She had an amenorrhea from November, 1925 until February 14, 1926, when uterine hemorrhages occurred. These stopped while the patient was kept in bed at absolute rest but immediately reappeared upon arising. On April 7 a mole was expelled. A microscopic examination was not made.

The hemorrhages continued and within two weeks bimanual examination revealed large masses of unknown nature in both parametria. On April 28 a panhysterectomy was done. The ovaries were the size of large oranges. Microscopic examination revealed a typical chorionepithelioma. The patient died from sepsis and peritonitis May 16, 1926.

CASE 3.—Mrs. B. O., aged twenty, gravida 1, para 0, was referred from the Cook County Hospital to Mercy Hospital for radiation therapy of a typical chorionepithelioma malignum with extensive metastases in the vagina. She gave a history of amenorrhea of two months' duration since August 6, 1927, followed by severe metrorrhagia, which was still existent on admission. She had marked vomiting of pregnancy. A mole was expelled on January 15, 1928, which was followed by pyrexia. On January 22 extensive invasive and ulcerative growths were found in left vaginal wall and parametrium. Microscopic examination of tissues revealed a typical malignant chorionepithelioma.

The treatment consisted in the intrauterine insertion of 2400 mg. element hours of radium filtered with 2.0 mm. brass and the application of 800 "r" x-rays each to a suprapubic and a sacral field from Jan. 31 to Feb. 14. The patient recovered anatomically and has remained well to the present writing.

CASE 4.—Mrs. S. M., aged twenty-two, gravida 2, para ii, was admitted from the Cook County Hospital for radiation treatment of brain metastases due to a recurrent chorionepithelioma on Feb. 10, 1928. The patient had had uterine hemorrhages for six months prior to a panhysterectomy performed for the hemorrhages in September, 1927. Seven weeks later intense headaches developed accompanied by a left-sided paralysis and in December, 1927 a tumor was discovered in the pelvis. A biopsy was then performed which revealed a typical malignant chorionepithelioma. X-ray doses of 800 "r" each were applied to brain and pelvic tumor. However the patient succumbed within three months.

CASE 5.—Mrs. A. C., aged thirty-nine, was admitted to the service of Dr. O'Donohue Sept. 9, 1928, stating that she had had an abortion in March, 1926 which was followed by a continuous bleeding from the uterus. A curettage followed by the insertion of radium intrauterine was made in September, 1927. A microscopic examination was not made. In May, 1928 persistent uterine hemorrhages, malodorous discharge, and pelvic pain appeared. A panhysterectomy was performed Sept. 12, 1928. The histologic examination revealed a typical malignant chorionepithelioma. Short wave x-rays were applied to the pelvis from Oct. 2 to 15 giving 800 "r" to the midpelvic region. The patient has remained well.

CASE 6.—Mrs. F. G., aged eighteen, gravida 1, para 0, was admitted May 13, 1929. She had had an amenorrhea for three months and uterine bleeding for the last four days. Examination revealed an open cervix, an enlarged uterus, the size of an eight weeks' pregnancy and a protrusion from the cervix of dark bluish grapelike masses. Biopsy revealed a malignant chorionepithelioma. A panhysterectomy was done May 14, 1929, and a dose of 800 "r" of short wave x-rays was applied to the midpelvis from June 1 to 29. The patient has remained well.

CASE 7.—Mrs. C. A., aged twenty-one, gravida 1, para 0, was admitted to the service of Dr. Vaughn Sept. 16, 1929. She had had an amenorrhea for five months and on Sept. 12 a mass was expelled spontaneously from the uterus which was followed by a continuous bleeding. A curettage was done on Sept. 16 but the bleeding continued.

The patient reentered the hospital October 7. A biopsy revealed a typical chorionepithelioma and a panhysterectomy was immediately performed. The patient is well at the present writing.

CASE 8.—Mrs. M. L., aged thirty-three, gravida 1, para 0, was admitted November 7, 1929. She gave a history of a hypermenorrhea for four months, followed by profuse and continuous metrorrhagia for the last two months. An x-ray picture revealed a fetus in transverse position in the lower uterine segment and an unusually large area of the supposedly amniotic sac. A spontaneous abortion occurred within twelve hours; a fetus of apparently three months' size and a normal placenta being expelled.

The uterus did not undergo involution. An examination on November 18 elicited an open cervical canal and a soft mass in the right posterior uterine wall. An immediate diagnostic curettage was made. The frozen section examination revealed a typical chorionepithelioma malignum. A panhysterectomy was immediately performed. Short wave x-rays were applied to the pelvis, the dose being 800 ''r'' in the midpelvis. The patient has remained well so far.

REFERENCES

(1) *Aschheim, S.:* AM. J. OBST. & GYNEC. 19: 335, 1930. (2) *Durante:* La Gynéc. No. 1, 1909. (3) *Ewing, J.:* Surg. Gynec. Obst. 10: 366, 1910. (4) *Fels, Erich:* Zur Biologie des Chorionepithelioms, Zentralbl. f. Gynäk. 53: 466, 1929. (5) *Fränkel, E.:* Samml. klin. Vortr. 180: 1897. (6) *Grosser, Otto:* Frühentwicklung, Eihautbildung und Placentation des Menschen und der Säugetiere, Dtsche. Frauenheilk., München., J. F. Bergmann, 1927; *Idem:* Med. Klin. 24: 20, 1928. (7) *Marchand, F.:* Monatschr. f. Geburtsh. u. Gynäk. 1: 419, 513, 1895. (8) *Meyer, R.:* in Henke und Lubarsch: Handbuch der speziellen pathologischen Anatomie und Histologie, Vol. VII-I, pp. 525-800, 1930. (9) *Rosenzweig, M.:* AM. J. OBST. & GYNEC. 13: 563, 1927. (10) *Schmitz, Henry:* J. A. M. A. 95: 1930. (11) *Szathmary, Zoltan:* Orvosi hetil. 70: 505, 1926. (12) *Zondek, Bernhard:* Zentralbl. f. Gynäk. 54: 2306, 1930.

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OBSTETRICAL MORBIDITY AND END-RESULTS

A PLEA FOR NEW MORBIDITY STANDARDS

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WITHIN recent years the medical profession has been concerned with checking up the end-results of its work. Scientific inventory-taking makes it possible to anticipate what will occur following a line of action if certain fundamental facts are given. The conclusions drawn from such studies by men of sound judgment and experience have been invaluable. Concerning obstetric morbidity this does not hold true. Our present morbidity records are not reliable.

Our attention was attracted to this subject from reading so many conflicting reports. The majority of published articles on this subject, in the last analysis, have proved nothing of a concrete, definite character. The subject has been considered from a multitude of angles. Studies have been based on as few as 89 cases and as many as several

thousand. Even the subdivisions, such as rectal versus vaginal examinations and morbidity, have resulted in a wide variance of opinion. It leaves one confused and incredulous.

All do not agree on the definition of morbidity. The fault lies in the fact that any summary of morbidity is apt to be valueless because there are so many standards in use. All are based on the index of temperature. On the one hand, one may choose the standard offered by the American College of Surgeons, the University of Michigan, the American Medical or British Medical Associations, etc. On the other, one may choose from standards set by individuals. DeLee, Goodall and Wiseman are examples of but a few of these. The majority accept the standard of an elevation of temperature of 100.4° F. on two successive or more days, not including the first twenty-four hours after delivery and not after ten days postpartum. And so, it resolves itself down to the fact that different workers have their choice of different standards for morbidity but all are based on a certain temperature for a certain period of time within fixed time limits. Etiologic factors, underlying pathology, future possibilities, or anatomical damage as a result of childbirth assume minor rôles. This leads to reports of morbidity findings as low as 3.4 per cent and as high as over 70 per cent. Surely such a wide variation shows on its face that something is amiss which calls for further consideration.

Therefore, believing that present methods of computing morbidity are wrong, we decided to review some of our own records to see if we were right in our premises.

J. O. Polak published the morbidity findings for five years (1924 to 1928 inclusive) totalling 5460 cases at The Long Island College Hospital. The average morbidity for the in-patient service was 10.52 per cent; for the out-patient service 3.10 per cent, an average of 6.86 per cent. Polak said, ''If we accept as febrile a morbidity based on a single rise in temperature on any day during the puerperium, we find that for all the years it is 73.96 per cent.'' Some years ago one of the writers (Welton) reported the mortality and morbidity figures for four years on the obstetric services at the Greenpoint Hospital, the cases totalling 3107. This was for the purpose of showing the results of conservative obstetrics. In addition we reviewed 1092 cases during 1929 at The Long Island College Hospital. We have grouped these findings and offer a composite review. We do not present these results for the purpose of impressing one with our morbidity findings, but to prove that if allowed to stand alone, as is the case with the majority of reports, they will be misleading.

Our gross morbidity was 7.80 per cent. This was based on the temperature standard offered by the American College of Surgeons. What does this morbidity mean? It means that seven and a fraction women out of every hundred, twenty-four hours following delivery, had a certain temperature for a certain length of time. A careful review of

the case histories revealed that these figures did not include all cases that were actually morbid, that many cases tabulated under morbidity were not such in a true obstetric sense, and that many patients who had pathologic findings but who ran an afebrile course were not, therefore, classed in the morbidity column. Some patients never ran a temperature above 100° F. until after the tenth or twelfth day. They were classed as negative although after that time positive complications arose.

Cognizant of these facts we believe our report of a morbidity of 7.80 per cent is valueless, except in so far as we learned that a certain percentage of women in childbed had at some time a certain temperature.

It has been said that obstetric morbidity varies with the seasons. Therefore we worked out our morbidity by months.

We found the morbidity by months to have been:

September	7.50 per cent
October	8.20 per cent·
November	8.60 per cent
December	7.50 per cent
January	8.10 per cent
February	10.20 per cent
March	8.80 per cent
April	8.0 per cent
May	8.1 per cent
June	6.8 per cent
July	6.6 per cent
August	5.3 per cent

From this one might conclude that the morbidity rate rose slightly during the winter months. However, it is well known that in certain areas the incidence of upper respiratory infections from November to April plays havoc with the morbidity rates. Upper respiratory infections were accountable for the following proportion of the listed morbidity:

September	1.3 per cent of total morbidity
October	3.8 per cent of total morbidity
November	26.1 per cent of total morbidity
December	34.2 per cent of total morbidity
January	40.0 per cent of total morbidity
February	38.3 per cent of total morbidity
March	26.4 per cent of total morbidity
April	9.0 per cent of total morbidity
May	4.1 per cent of total morbidity
June	0.8 per cent of total morbidity
July	1.1 per cent of total morbidity
August	0.4 per cent of total morbidity

If this be true then our supposed corrected morbidity is lower during the winter months. However, this, too, is a trick with figures based on temperature.

Many conditions having no or only a remote relation to the pregnant state were found to account for fever in addition to upper respiratory infections. We list: toxic urticaria, appendicitis, septic endocarditis, pyelitis, massive collapse of the lung, cystitis, Vincent's angina, pulmonary embolus, infected teeth, abscess of Bartholin's

gland, pneumonia, pleurisy, infected hemorrhoids, gall bladder affections. In a large number of cases no cause for the temperature could be discovered. These conditions (and others no doubt not diagnosed) caused an increase in the obstetric morbidity figures.

Deducting all causes not related to obstetric pathology we found the true causes for fever to have been: lochiometra, endometritis, mastitis, breast abscess, parametritis, peritonitis, thrombophlebitis of the pelvic veins, phlegmasia alba dolens, bacteremia, rupture of an ovarian abscess, infection of the perineum and cervix, and the postoperative rise following cesarean section.

Exclusive of all causes for fever having no bearing on the parturient state or related to pregnancy, the corrected morbidity would be:

September	4.3 per cent
October	5.1 per cent
November	4.3 per cent
December	3.9 per cent
January	3.8 per cent
February	4.1 per cent
March	5.1 per cent
April	3.7 per cent
May	4.2 per cent
June	4.4 per cent
July	5.0 per cent
August	5.1 per cent

This gives a corrected morbidity of 4.5 per cent. On dismissal from the hospital only 0.6 per cent could be placed in the morbidity class.

We looked deeper into this corrected morbidity rate in an attempt to ascertain if this supposed true morbidity percentage had any practical value. We concluded it meant nothing. For, in studying these individual records it was surprising to note how many patients ran temperatures, often above 103° F. for a short time (one to three days), in which no positive findings were present. Suddenly the temperatures permanently dropped to normal. Repeated examinations and laboratory check-up gave negative reports. We will never know what occurred. No physical damage was done. It was merely curious that these women ran a high temperature for a short time. Yet, such cases are classed as morbid. It only proves that some transient, mild obstetric complication was present that quickly cleared up, leaving the patient in a normal condition. No matter how we tabulate or juggle such figures we will not learn how to prevent such flare-ups in the future.

On the other hand, we noted that many patients ran a low degree of temperature (99° to 100.2° F.), for days, with well-defined evidence of trouble present. We did not include such cases in the morbidity tables as they did not come under our standard for morbidity. For all practical, common sense purposes they should have been included. Also we observed it is common for a febrile state to exist for several days following a perineal repair. Some authors have contended that

the morbidity following episiotomy is less than after frank lacerations. Either way, these are listed as morbidity because of the temperature, although the trouble is temporary and the end-results negative. Some patients had temperature rises on several days apart, such as the second, fifth, and ninth days. Sometimes such temperatures were 101° F. or higher, and yet they were signed out afebrile. It has happened that some of these women have at a later date returned to the hospital with extensive exudates or other serious pelvic pathology. We have in mind a woman who never ran a temperature above 100.2° F. but who developed a pelvic abscess that had to be drained. Although truly morbid she was not included in that class.

Polak conducted studies on morbidity following rectal and vaginal examinations. The difference was slight. However, he learned, in one series, that there was a morbidity rate of 95.9 per cent in women who had had neither vaginal nor rectal examinations and who delivered spontaneously. Suppose these figures stood without the explanation that all these women went into labor while suffering with severe upper respiratory infections and fearing a spread of the contamination no examinations were made. They would not really represent an obstetric morbidity. Nevertheless, in the tabulation of all our cases they are included in the morbidity class.

L. Grant Baldwin studied the subject of mercurochrome vaginal instillations prior to delivery and presented figures according to three standards of morbidity classification. The reported end-results were far apart according to each classification.

In our case we learned that our gross morbidity based on temperature was 7.8 per cent; that our corrected morbidity was 4.5 per cent; that from November to April 25 to 40 per cent of the morbidity was due to upper respiratory infections; that should we include with these, breast infections and infection of the kidney tract they would bring the rate up to 75 per cent; that on dismissal from the hospital less than 1 per cent had any obstetric pathology present; that according to our classification some cases had definite pathology but were not morbid according to the rules; that many were morbid from unknown causes which were never discovered. We could work out other ingenious angles, but after all is said and done we would prove nothing of any importance or accuracy, except, perhaps, that endless factors, some known, many unknown, will cause temperature.

Do not gather from these remarks that we would have you insensible to obstetric morbidity. It is an ever-present menace to childbearing. It is an elusive thing, at times hard to classify or explain. So many factors enter into it that often we can discover no one cause. Efforts must be continued to lessen true obstetric morbidity.

We have tried to point out that morbidity records based on temperature alone are confusing and inaccurate. For, after all, tempera-

ture is but a symptom as is pain, a foul lochia, a chill, and surely of no more importance than certain physical findings such as abdominal tenderness or distension, a peritoneal rebound, a pelvic mass, bacteria in the blood stream or a high differential and leucocyte count.

Therefore, we venture to offer for discussion other standards for computing obstetric morbidity. We would list as morbid every patient who gave evidence of any definite or prolonged pathologic condition with or without fever directly resulting from childbirth. We would exclude all intercurrent or incidental affections not crossing the borders of or impinging on the postpartum state. We would include all anatomical damage and mechanical derangements resulting from childbirth that would affect the health of the woman, i.e., inversion of the uterus, rupture of the uterus, cystocele, rectocele, prolapse of the uterus, a badly lacerated cervix, or unrepaired or broken down extensive laceration of the perineum, and all fistula in the genital tract. We would include all of these, whether found with rise of temperature or not. Any condition resulting from childbirth that causes any degree of prolonged ill health, that renders the woman more or less invalid, that may cause future sterility or make future childbearing a dangerous experience, we would list as morbidity. Fever, a likely and important factor in the symptom complex might be a means of arriving at the end, but would not be the end itself. Every case dismissed from the hospital should be reexamined a month or six weeks postpartum before the records are closed.

We have not attempted to formulate a fixed, rigid set of rules, but have offered these suggestions in broad outline, feeling that when other standards for computing obstetric morbidity than that of the one index of temperature now in use are accepted by all men, we will then have records of accuracy and practical worth.

842 UNION STREET.

Flusser, E.: **Vulvitis Aphthosa.** Monatschr. f. Kinderheilk. 43: 123, 1929.

Vulvitis aphthosa is defined as a lesion occurring about the vulva similar to that found in the stomatitis aphthosa of the mouth and derived from the latter. The author knows of no previous record of the condition, although stomatitis aphthosa is well known. The vulvitis aphthosa of the older writers had no connection with the lesion of the mouth but was identical with thrush or noma.

The case presented is that of an acutely ill child, seven years old, who acquired a severe stomatitis aphthosa, which was carried to the vulva manually. The lesion is described as being composed of red nodules 2 to 4 mm. in diameter, the larger ones having gray centers. Pustules with central umbilication are also seen. It extended over the mons, labia majora, labia minora, and mucous membrane of the vulva. The latter was thickened and angry red in color, and the hymen was also involved. Treatment consisted in neosalvarsan intravenously and was followed by almost immediate relief.

FRANK SPIELMAN.

VAGINAL REPAIR

By A. J. Rongy, M.D., New York, N. Y.

IN RECENT years gynecologists have assumed a different attitude toward vaginal repair during the childbearing period. Formerly vaginal repair was done indiscriminately, giving little thought to the complications that might arise during subsequent labors as a result of these operations. I believe that the predominating opinion now is to avoid vaginal plastic operations on women during the period of fertility.

However, there are many instances when vaginal repair must be performed during the childbearing period. Many women, as a result of difficult and ill-managed labors, suffer such great damage to the genital tract that they are physically disabled. Vaginal repair in such cases becomes an operation of necessity, not of choice.

It is not my purpose at this time to discuss the technic of any operative procedure or to give tables of statistics of the results obtained in given series of cases, or the relation which a particular operation may have on subsequent pregnancy and labor. I assume that at this stage of gynecologic surgery this would be superfluous and it would only be a repetition of subject matter in which medical literature abounds.

Once vaginal repair is decided upon, it is the function of the gynecologist to give consideration to some of the other aspects associated with these procedures beyond the immediate question of technic or type of operation to be performed. What then are some of the essential points which are to be taken into consideration in connection with vaginal repair? The following will be discussed catagorically:

1. The anatomic construction of the bony pelvic outlet.
2. The interpretation of the mechanics of labor.
3. The sexual function.
4. Surgical sterilization.
5. Prophylactic episiotomy.

1. *The Bony Pelvic Outlet.*—The success of vaginal repair, to a large degree, depends upon the correlation of the soft pelvic structures to the bony outlet of the pelvis. The formation of the pelvic outlet varies in different types of women. In normal cases a line drawn transversely across the ischial tuberosities divides the pelvic outlet into anterior and posterior segments. It will be found that the anterior segment measures about 7 cm. and the posterior segment about 9 cm. In some women, however, the anterior segment of the pelvic outlet is narrow and shortened. In others the reverse is true.

The damage to the soft pelvic structures, which takes place during labor, normal or abnormal, has a definite relationship to the type of pelvic outlet of the patient.

Women who have contracted anterior segments are less likely to develop a cystocele because the fetal head in these cases is born at the expense of the posterior segment. The subpubic structures, including the supports of the bladder wall, therefore escape the constant assault, which the head makes on the tissues of this region. It is the posterior segment or the structures composing the pelvic floor and perineum, which are likely to be torn.

Again, women in whom the posterior segment is contracted are more likely to have greater cystocele formation, because the head is born at the expense of the anterior segment.

In undertaking vaginal repair the anatomic peculiarities of the pelvic outlet must be borne in mind, because the reconstruction of the torn tissues and replacement of the genital organs must be carried out in accordance with the anatomic formation of the pelvic outlet.

In the vaginal fixation operation for procidentia the point of anchorage of the anterior wall of the uterus to the upper angle of the vagina, whether high, middle, or low, depends upon whether the anterior segment of the pelvic outlet is short or long. The extent of the separation of the bladder wall laterally is also greatly influenced by it. In these patients the uterus, not the bladder, forms the greater part of the hernia, and therefore there is no need of extensive separation of the bladder from the surrounding structures. What is primarily necessary in such a patient is a proper point of fixation of the uterus and as little separation of the bladder as is possible to finish the operation. This helps to preserve the bladder function and little vesical disturbance will follow the operation. The repair of the damaged posterior wall in these patients, however, must be complete. The line of denudation must extend sufficiently high to the point where the vagina and rectum are in juxtaposition, thus exposing the entire muscular structures of the pelvic floor. The suturing of the levator ani muscles must be begun at a point of their greatest divergence which is within the reach of the operator. A complete pelvic diaphragm will thus be made and it will prevent the uterus from sliding out again from the vagina.

In patients in whom the posterior segment is shortened the hernia is largely formed by the bladder. The uterus usually sags behind the bladder; the perineum is damaged comparatively little. In such cases the bladder separation must be carried out extensively. The fixation point of the uterus must be high near the fundus. The bladder is made to rest on the posterior wall of the uterus, thus making it impossible for the cystocele to recur. The narrowing of the vaginal canal must be accomplished at the expense of the anterior vaginal wall. The

perineum in these patients usually is not badly lacerated and therefore a simple type of perineorrhaphy is sufficient to complete the operation.

2. *The Mechanics of Labor.*—A proper conception of the mechanics of labor is necessary in order to carry through successfully the delivery of the fetal head with forceps.

We have been taught to interpret "position" as a mechanical necessity, a process by which the longest diameter of the head accommodates itself to the longest diameter of the pelvis. This is only partly true; the fetal head for all practical purposes is a true sphere and therefore must be governed by the same mechanical principles that govern the movements of a sphere. The complications that arise during labor in malpositions are due to the fact that the head loses the properties governing the motion of a sphere, because there is a lack of proper approximation of the fetal neck and the pubic arch. It is the degree of angulation of the neck and the proximity of the angulated portion of the neck to the pubic bone, which make it possible or impossible for the fetal head to follow the laws that govern the passage of a sphere through a cavity approximately of the same size and shape.

It is the lack of understanding of this principle in the mechanism of labor which makes the use of forceps dangerous and very often causes irreparable damage to the genital tract. The delivery of the head with forceps is impossible unless the head is in a position when the forceps in its grasp of the head is causing the proximal hemisphere of the head to become engaged. Any deviation from this principle in the use of forceps leads to great damage to the birth canal. The incidence of birth canal injuries is on the increase because of the injudicious use of forceps. The necessity for vaginal repair is therefore becoming more urgent.

3. *Sexual Relationship.*—Not infrequently husbands become impotent and are unable to copulate with their wives, but are quite virile and able to perform the sexual act with other women. For this, there are, of course, many reasons. It seems to me that in a number of instances the impotence of the husbands could be accounted for by the fact that they lack the necessary stimulation for the orgasm, because of the complete relaxation of the vaginal canal. They cease to enjoy the sexual act; this leads to impotence.

Some years ago I made inquiries from a number of husbands whose wives had undergone vaginal repair, whether they noticed any change in their sexual relationship. Many informed me that apparently their sexual powers had increased and they enjoyed the sexual act much more since their wives had been operated upon.

I then made a study of 100 individuals with the following results: 17 were impotent before the operation; 5 regained their virility, 14 remained impotent; 26 stated that sexual intercourse had become more pleasurable; 12 stated that they were able to have sexual intercourse

more frequently; 8 stated that the orgasm was somewhat more prolonged; and 45 noticed no change.

The women in this group noticed no change in the sexual act except that 9 women had varying degrees of dyspareunia, as a result of scarification and narrowing of the vaginal canal.

I am convinced that proper reconstruction of the vaginal vault does help to enhance the sexual powers of the husband in no small number of cases, especially in men who have passed middle age and whose sexual powers are on the wane. This alone not infrequently may be a sufficient reason for advising vaginal repair.

4. *Surgical Sterilization.*—No matter what opinions we may hold on the question of birth control, it is certain that there are definite indications from a purely medical standpoint for surgical sterilization in a large number of patients who came to operations for pelvic disorders. Furthermore, in a great number of patients pelvic repair would be futile and would lead to grave complications in the event of subsequent childbirth if they were not sterilized. Therefore sterilization has now become a routine procedure in the more aggravated cases of vaginal repair. Patients who require a vaginal fixation for partial or complete procidentia should be sterilized. If the patient is unwilling to be sterilized, the operation should not be undertaken and some other form of repair should be done.

In the course of my work I have found it necessary to sterilize a great many women. I have never sterilized a patient who had only two children, unless especially requested to do so by both husband and wife after they had deliberated and discussed the question thoroughly. Women who have three or more children I usually advise to be sterilized at the time of the operation.

I have had an unusual opportunity to observe a great number of patients who have been sterilized. I have watched them not only from the standpoint of altered physiologic function of the genital tract, but also as to their mental attitude and general psychologic reactions toward their children and husbands. Some of the women appeared as if they had received a new lease on life. A good many assumed a different attitude toward sexual relationship; they no longer abhorred and feared the approach of their husbands. With the exception of one patient none regretted that she had been sterilized.

Now, this may seem a liberal attitude on my part to assume concerning the question ·of surgical sterilization, but I believe that the time has come when the husband no longer will be able to consider it his right to gratify brutally his sexual desires without regard for his partner.

Sterilization can be accomplished easily through the vagina in cases of procidentia of the uterus; it does not unduly prolong the operation. The best method is that of resection of the fallopian tubes at their

isthmial portions, embedding the cut ends in the cornua of the uterus. During the past ten years sterilization by this method was performed by me in about 250 cases and there were only four failures reported.

5. *Prophylactic Episiotomy.*—In recent years obstetricians have advocated prophylactic episiotomy, either unilateral or bilateral, during the delivery of a child with forceps or before the delivery of the after-coming head. Proponents of this procedure claim that the preliminary incisions in the vaginal walls create a surgical wound, that the repair of such a wound can be done in a surgical manner, while if the perineum is torn spontaneously as the head or shoulders are being born the resulting wound is ragged and irregular and more difficult to repair.

There is, however, another phase to this procedure which the obstetrician fails to take into consideration. In a great number of patients the episiotomy wounds become secondarily infected, and healing does not take place by primary union. This results in cicatrization of muscular and fascial structures of the perineum. Vaginal repair in such cases very often cannot be performed properly because the anatomic structures of the vaginal vault are distorted, making it difficult to dissect the tissues correctly. Furthermore, even if repair is properly accomplished, the tissues are so devitalized that primary union does not take place in a great number of cases.

If the obstetrician thinks it necessary to do a preliminary incision of the perineum, I believe it more logical to perform a perineotomy. It can be more readily repaired than an episiotomy wound. If secondary infection takes place following a perineotomy, the structures are less distorted and secondary vaginal repair is therefore less complicated.

The type of operation to be performed for the correction of procidentia uteri is still a controversial question. I have had ample opportunity to observe the results of the various operations now utilized for the cure of the dislocated genital tract, and have come definitely to the conclusion that the vaginal fixation operation or what is popularly termed the interposition operation, properly executed in selected cases, will cure the largest number of patients.

Some gynecologists object to this operation because they claim that a great many patients have vesical disturbance following it. Others are disinclined to perform it because of the technical difficulties that may be encountered during the operation. Nevertheless, I believe that these obstacles can be easily overcome by those who have acquired the necessary experience in performing plastic operations on the genital tract.

The only criteria for the efficacy of any procedure for the correction of the prolapsed genital organs are: (1) The permanency of the repair, and (2) the return of the parts involved to normal function

and position. This is more readily accomplished by the vaginal fixation operation. When this operation is performed in women during their period of fertility, sterilization should be done, for a labor subsequent to this operation may endanger the life of the mother.

The choice of anesthesia is important in this group of cases. A great many of these patients have passed middle age; some of them come to operation in the sixth or seventh decade of life and give a history of having suffered from procidentia ten or more years. Due to prolonged congestion and irritation the parts have become thickened; they have lost their normal sensitiveness. It is therefore not uncommon to find that a goodly number of cases do not require any anesthesia whatsoever for the operation. Surely a very large percentage of these patients can be operated upon under local anesthesia.

The following case illustrates that vaginal fixation can be performed without anesthesia:

Mrs. M. C., aged forty-eight, para viii, admitted to Lebanon Hospital, July 30, 1930, giving a history of difficulty of urination for the past four years. Since the birth of the last child nine years ago, she had complained of frequency of micturition, having to get up three or four times at night. For the past five years she had felt the "womb" protruding from the vagina. Menopause January, 1930. She had been admitted previously to the hospital, but operation was not done because of complicating nephritis and hypertension. Local examination disclosed a complete prolapse of the uterus. Operation July 31, 1930. No anesthesia, except a preliminary dose of morphine, gr. 1/6. Operation began at 11 A.M., ended 11:40 A.M. Blood pressure on the morning of operation was 210/108. Urine negative. R.B.C. 3,650,000, hemoglobin 60 per cent, W.B.C. 5,900. The patient was discharged from the hospital August 13.

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Halban, J., and Spitzer, M. Z.: The Increased Growth of the Nails During Pregnancy. Monatschr. f. Geburtsh. u. Gynäk. 82: 25, 1929.

During pregnancy there is not only a purposeful growth impulse such as is evidenced in uterus, vagina, and breasts but also a general growth such as is manifest in the increase in height in young gravidas. The hair likewise grows more rapidly during gestation and this fact caused the authors to investigate the growth of the finger nails during pregnancy. A review of the literature failed to reveal any similar study during normal pregnancy. The authors carefully measured the nails of many pregnant women and they report the results in a careful study of 93 women. For normal standards they accepted the results of others who studied nonpregnant individuals and they themselves measured the growth of nails in 23 nonpregnant woman. The conclusion reached was that during pregnancy the growth of the finger nails is about one-fourth to one-third greater than it is in the nonpregnant state. This increase begins soon after conception takes place. As soon as the pregnancy is ended, be it at full term, by premature labor, or by abortion, the rapid growth ceases suddenly and the increase in length progresses more slowly than normally for a while. The authors found that a few women failed to show this phenomenon during pregnancy.

J. P. Greenhill.

OBSERVATIONS ON TOXEMIC NEPHRITIC GROUP CASES WITH SPECIAL REFERENCE TO CLASSIFICATION

By Foster S. Kellogg, M.D., Boston, Mass.

FROM 1919 to 1928 I published six papers* based on studies made with the view of clarifying this subject in my mind.

Briefly and as applied to this phase the results of the work may be stated chronologically as follows: (1) Recognition of the need for accurate definition in this group for proper treatment, which we lack to a marked degree. (2) The autopsy proof of the entity "recurrent toxemia." (3) The definition of the term "recurrent toxemia." (4) A proposal to index tentatively all these cases under three heads for future study: (a) Acute toxemia. (b) Pregnancy complicating chronic nephritis. (c) Recurrent toxemia. (5) An expression of disagreement with the dictum that toxemia leads to chronic nephritis, and the postulation of the theory that in the majority of instances an insufficient kidney, not demonstrable by our relatively coarse tests, exists before the pregnancy, and that pregnancy is the best available test of kidney function. (6) That a cooperative study throughout the United States under a single classification is highly desirable. (7) That from a study of 1200 cases the only improvement we could find of results had come from active interference *before* the convulsive stage in the toxemia patients and before marked kidney damage, as shown by blood chemistry and eyeground changes, in the chronic nephritic patients. (8) That there is no profit in babies and progressive maternal damage in attempts to carry definitely established nephritic patients through pregnancy, and that they should be segregated and sterilized or put under effective pregnancy prevention. (9) That the recurrent group gives a 50 per cent profit in babies without damage to the mother, if properly handled. (10) We emphasized the close relationship between mild, severe, eclamptic toxemia, and premature separation of the normally implanted placenta. We called attention to the hitherto unnoted importance of anuria as a cause of death in these cases, brought out the paucity of autopsy material and our ignorance of just what happens in the kidney, and attempted a tentative rationale of treatment.

Owing to the interest of the chief a special toxemic clinic was established at the Boston Lying-In Hospital in August, 1925. In expectation of this we had kept a special index beginning June, 1923, so that we were able to use our material retroactive to that date. Further on I shall report some of the results seen in this clinic from June, 1923, to June, 1930, a period of seven years.

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*The references to these publications may be found in the bibliography.

In the meanwhile unquestionably the outstanding piece of work in the world in the study of toxemias, at least from the angle of classification, was being accomplished. This work was taking place at the Johns Hopkins University Medical School and it culminated in 1929 with the publication of a monograph called "The Toxemias of Pregnancy," by H. J. Stander. Williams and Stander had recognized the positive need for such a classification. It is impossible to overestimate the value of this contribution.

For reasons immediately to be outlined this classification should be for the present limited as follows:

1. Low reserve kidney.
2. Nephritis complicating pregnancy.
3. Preeclampsia.
4. Eclampsia.

Stander himself has demonstrated that "vomiting of pregnancy" (number one in the original classification) does not belong in the classification. He has reproduced by starvation the lesions of this condition, including central necrosis of the liver, and believes that it should be omitted.

Group six in the original classification, "acute yellow atrophy of the liver," is not peculiar to pregnancy, and, since we are concerned with toxemias peculiar to pregnancy or with nephritis as a complication of pregnancy, we believe it should be excluded and considered as a separate entity.

Permit me to make three dogmatic statements regarding this classification: (1) It obviously does not cover all the material seen in this group. (2) So far as it goes, it appears to be soundly scientific even though somewhat arbitrarily conceived. (3) Since to date it is the only classification based on sound scientific study and keen experienced clinical observation, it seems most desirable that it should be universally accepted for the present in the United States as a basis for the study of this group. With this feeling it is my intention to attempt in the future to reconcile, in so far as we are able, each case passing through our clinic with this classification.

Such minor criticisms of this classification as I have to make will become apparent in a report of the results from our clinic. These criticisms are intended to be purely constructive and purely suggestive and in this spirit I am sure they will be taken.

The figures which I am about to give must be brief. To those interested in detail, complete tables may be found in a paper by Berman called "Observations in the Toxemic Clinic, Boston Lying-In Hospital," noted in the bibliography.

In the seven years of the clinic approximately 1100 separate toxemic-nephritic patients were observed. Of these, for lack of sufficiently com-

plete study and on the only data available, 15 per cent were set down as chronic nephritis, 50 per cent were set down as acute toxemia, and 35 per cent as recurrent toxemia. The criteria for a chronic nephritic patient in the clinic is that a patient shall have a persistently elevated blood pressure one year after delivery, eyeground changes, and fixation of specific gravity. We may dismiss this group and the figures as practically unworthy of consideration, since we have insisted that without careful interval study or without study in two or more pregnancies, we are totally at sea as to where these patients truly belong.

We come, then, to a group of 293 patients who have been seen or studied in two or more pregnancies.

Of these, 164 have been carefully observed between pregnancies. Our only observation on the interval study cases, and we offer no explanation of our figures, is this: that of the patients who came to us with albuminuria as well as hypertension when pregnant, about 25 per cent came back with definitely elevated blood pressure during the interval study. In the group of patients with hypertension and no albuminuria, about 50 per cent came back with elevated pressure in the interval study.

In a group of 225 patients seen in two pregnancies only, but 20 per cent were normal throughout the second pregnancy and so may be called acute toxemia patients, at least so far as we have gone with them. Eighty per cent showed a recurrence of albuminuria and elevated blood pressure. Of these, 20 per cent approximately were established nephritic patients; 10 per cent were doubtful, because, though they maintained hypertension at the end of a year, they showed no eyeground changes or fixation of specific gravity, and 50 per cent are listed as recurrent toxemias; i.e., patients in whom chronic nephritis cannot be diagnosed, even with the help of pregnancy as a test.

There were 68 patients seen in more than two pregnancies. We have a general impression from this group that, on the whole, as progressive pregnancies occur, the patients tend to get worse earlier in pregnancy and that we are able to demonstrate with added pregnancies more and more established nephritic patients.

Berman shows by study of the group of 293 patients observed in two or more pregnancies that with increasing parity there is a rise in the incidence of recurrences and nephritis and a decrease of normal pregnancies. He points out that the group with 140 to 160 blood pressure level without albuminuria seems to occupy the place of paramount importance in this progressive degeneration. We have the firm impression from this that ultimately we shall find a group of women, using pregnancy as a test, who demonstrate familial cardiovascular insufficiency. We believe that in order to check this and give them their best chance for a reasonably prolonged life, we may be obliged to segregate and steri-

lize or otherwise prevent too great a succession of pregnancies, precisely as in the established chronic nephritic patients, though without the ability to make that diagnosis.

We will now attempt to reconcile our 293 repeat cases with the Hopkins classification. We find 26 per cent that may be classified as low reserve kidney, and in this group we include some cases less in severity than the criteria for this group call for. Our chronic nephritic patients represent 20 per cent. Our eclamptic patients represent 9 per cent. Our doubtful cases represent 10 per cent. This leaves us with 35 per cent of cases which we cannot consider as low reserve kidney. Similar behavior in repeat pregnancies is the Hopkins requirement for low reserve kidney. This 35 per cent did not so behave.

The Hopkins classification states that only 5 per cent of cases are preeclamptic toxemia. This is our major criticism of the Hopkins classification and its implied teaching. Somehow this 30 per cent difference must be reconciled. According to the Hopkins percentages 35 per cent of the group is left to be divided between vomiting, yellow atrophy, and eclampsia. We think this too high for eclampsia and that it substantiates the point we are about to develop. We believe it incorrect teaching in a country in which, according to Stander's monograph, 26 per cent of maternal deaths are due to so-called toxemias of pregnancy, to state that so great a group of albuminuric-hypertension cases may be trusted not to go on to eclampsia. We prefer to assume and to teach that every albuminuric or hypertension case is a potential eclamptic. Before the publication of this paper, Irving will have shown that in the past ten years the mortality in eclampsia at the Boston Lying-In Hospital has improved very little except by the elimination of shock deaths by rapid delivery or cesarean section, save for a series treated by him by plasmapheresis, too small and too experimental to consider yet, but very encouraging. Otherwise, our best mortality rate by conservative methods is 20 per cent. We observe throughout the state of Massachusetts and must conclude from the published statistics of the country that toxemias without convulsions or preeclamptic toxemias or whatever people may care to call them, are carried too far without interference with pregnancy. In our own hospital we have only saved lives to any marked extent by interruption of pregnancy prior to the convulsive stage. Therefore, while we do admit the academic existence of the low reserve kidney group, we feel strongly that it should not be preached for public consumption until more facile methods are put forth for its ready and certain identification. We think the term preeclamptic toxemia should be used to cover a broader field than as now defined in the Stander monograph. We fancy the term with its implication of impending eclampsia and its indication for ceaseless watchfulness.

CONCLUSIONS

We believe we are justified in drawing the following conclusions:

1. That a classification of the toxemic nephritic group is an essential in this, the most important problem in obstetrics.

2. That the Hopkins classification is so sound and so much in advance of anything that has preceded it that it should be adopted in every clinic in the United States.

3. That an organization to meet once a year and discuss this group in a cooperative manner will further rapid progress in the solution of the problem more than anything else.

4. That at present there appears to be a marked discrepancy in the proportions of the "preeclamptic toxemia" group in the two studies. An explanation may be that we are too purely clinical or that the Hopkins scheme is too purely scientific in case requirements to fit this group. I suspect it is a little of both. At all events since the crux of treatment at present lies in this group, we must make every effort to reconcile our figures.

5. That all of us as enthusiasts should be slow to promulgate theories of special treatment of eclampsia and for the present, until we have gathered sufficient data, we should concentrate all our teaching effort toward the principle of preventing convulsive toxemia, first by the customary slogan of prenatal care, and to my mind, the still more important principle of *preconclusive interference*.

REFERENCES

(1) *Kellogg, F. S.:* Am. J. Obst. & Gynec. No. 4, April, 1922.   (2) *Kellogg, F. S.:* Am. J. Obst. & Gynec. 8: No. 3, September, 1924.   (3) *Kellogg, F. S.:* Am. J. Obst. & Gynec. 9: No. 2, February, 1925.   (4) *Kellogg, F. S.:* Boston M. & S. J. 197: 771-773, Nov. 3, 1927.   (5) *Kellogg, F. S.:* Am. J. Obst. & Gynec. 15: 122, January, 1928.   (6) *Kellogg, F. S.:* Am. J. Obst. & Gynec. 15: p. 357, March, 1928.   (7) *Stander, H. J.:* Vol. XV, Medicine Monographs, The Williams and Wilkins Company, 1929.   (8) *Berman, S.:* New England J. Med. 203: No. 8, Aug. 21, 1930.

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Hofbauer, J.:   Treatment of Pyelitis Gravidarum.   Arch. f. Gynäk. 134: 205, 1928.

Hofbauer feels that the oral or intravenous administration of antiseptics in acute pyelitis gravidarum is contraindicated because of the involvement of the adjacent kidney parenchyma. The diet should be regulated so as to exclude all albumins and to include large quantities of vegetables and of milk sugar. Pituitary extract has a specific antiphlogistic action upon the urinary tract and increases ureteral and vesical peristalsis. The author has never seen a pregnancy disturbed nor terminated by such pituitary extract injections. He uses three daily injections of the pituitary extract (one-half ampule of pituitrin) with very good results.

RALPH A. REIS.

APPLICATION IN FORCEPS EXTRACTION

By Paul T. Harper, M.D., Albany, N. Y.

CHOICE of the above subject for presentation before the Association springs from a conviction that none other than cephalic application should be taught.

It is believed that oblique-cephalic and pelvic applications entail disadvantages and dangers that nothing less than stern necessity would seem to warrant, and that they should be relegated to the category of emergency measures as scientifically unsound as forcible dilatation of the cervix and as little less hazardous to the child than version and bringing-down of the half-breech in the control of hemorrhage due to incomplete placenta previa.

Discussion is limited to consideration of cases wherein the head is engaged,—in other words, wherein the biparietal diameter is in the inlet. At higher levels, heads are unengaged, or "floating," and to them it is presumed forceps application would not be considered. Below the inlet, cephalic application alone need be considered. The instances wherein even an initial oblique-cephalic application is necessary are extremely rare.

Of true cephalic application it may be said: First, it is safe. With the head grasped by its biparietal diameter, firm instrumental pressures are exerted over resistant bony prominences,—the parietal eminences, and the malar and zygomatic processes. Second, true cephalic application is possible only as the exact position of the occiput is known; and such information is demanded if one would know the extent and direction of rotation that must follow. Third, true cephalic application is possible in practically every case where forceps advance is desirable.

Cephalic application is known to be safe, and it is conceded that knowledge of the exact location of the occiput is essential to the intelligent conduct of forceps operations.

But it will not be readily granted that other than cephalic application is practically never necessary where operative advance is desired: and this for two reasons. First, in rare instances the initial application may have to be oblique-cephalic; and second, there is far from universal accord with the proposition that, where a difficult instrumental advance threatens, delivery by elective version and extraction is superior to delivery by forceps.

At any rate, perfect cephalic application is far from the rule. From experience in hospitals where specialists and general practitioners are conducting cases, it would seem that pelvic and oblique-cephalic ap-

plications are not uncommon, not merely as initial applications made necessary by high position of heads but also as applications too often persisted in until delivery has been accomplished.

Reasons for the frequency of imperfect applications are easy to discover. First, oblique-cephalic and pelvic applications are easier to make and, second, each has a time-honored place in the literature.

There is little incentive for the indifferent operator to master the details of orientation of the occiput and perfect cephalic application when there is standard textbook authority for ''inserting the blades at the sides of the maternal pelvis and, without knowledge of position of the occiput, grasping the head, when the latter is known to be high.'' Thereafter, if the grasp is firm, especially if fenestrated blades are used and, finally, if sufficiently strong tractile efforts are made, all know that a successful advance is practically assured.

True, the operator is directed to reapply the forceps cephalically when the level of the midpelvis is reached; but such is believed to be far from the rule. Again, the operator might claim that an application that was permissible at the beginning of an instrumental advance might be quite reasonably held until delivery was accomplished; and he would not be wholly illogical in his contention.

The high percentage of oblique-cephalic applications seen in consultation convinces one that cephalic application even in midpelvic arrest of ''posteriors'' is far from the rule.

There is unquestionably an attitude of general indifference toward the method of applying forceps and for this condition teachers must assume the essential responsibility.

But granted that there is a place for other than perfect cephalic application. Hypothetical cases of high arrest of the head, wherein oblique-cephalic or pelvic application is required, at once suggest themselves. For example, with arrest in the transverse diameter of the inlet, pelvic application alone may seem possible. Again, with arrest in an oblique diameter of the inlet, an oblique-cephalic application may be the best. It is assumed that one or another of the conventional forceps is being used.

Now, presume instrumental advance to have been determined upon. Certain disadvantages and dangers appear. They are familiar. They obtain even though the operator is skilled. Briefly considered, they are as follows:

With a pelvic application to well-flexed heads, the sincipital blade slips over the ''long'' face while the tip of the other blade exerts dangerous pressure at the base of the ''short'' occiput. Grasp on the head is insecure, especially when the solid blade forceps is used, and it results in inevitable facial traumatisms when compensated for by tightening the grasp on the handles. Even more undesirable are the

results when a fenestrated-blade instrument is used, for the reason that it can be made to hold no matter how applied.

On the other hand, with pelvic application to deflexed heads, the hold is more secure, because the curves of the sinciput and the occiput conform reasonably well to the cephalic curves of the blades. It is not too secure, however, because the tips are widely separated, due to the long head-diameters grasped. A mechanical defect of this application, at least worthy of mention in this connection, is the possible lengthening of the biparietal (the engaging) diameter as the result of pressure on the sincipital and the occipital blades.

While oblique-cephalic application is responsible for fewer basal injuries than is pelvic, pressures over a stylomastoid foramen with facial-nerve damage at its exit therefrom are common, as are also laceration and contusion about the opposite orbit. Further, remembering that the forceps blades are parallel when locked, it is inevitable that firm localized pressures are exerted by the anterior edge of one blade and by the posterior edge of the other when applied obliquely to the head. The edges contuse in every case. They cut when the grasp is firm and traction is strong enough.

But still presume instrumental advance to have been determined upon. A perfect cephalic application in inlet arrest is possible, provided one chooses either the Kjelland or the Barton forceps.

While the Kjelland can unquestionably be applied cephalically at the inlet and while its sliding lock assures perfect application even to asynclitic heads, there would seem to be little more to say for the Kjelland in this connection. For the direction of initial advance occasioned is nonphysiologic. The handles of the "straight" Kjelland when applied high cannot be directed far enough posteriorly for the head to advance downward and backward in a line perpendicular to the plane of the pelvic inlet. The Kjelland forceps has a place in the obstetric armamentarium; but its field is other than inlet arrest.

On the other hand, the Barton forceps not only makes perfect cephalic application to heads at the inlet possible but also,—and this is most important,—it assures an initial advance in the physiologic direction; namely, downward and backward. Limited personal experience with the Barton forceps in inlet arrest, occasioned by fear of partial separation of low-lying placentas and cord prolapse at sweep of the anterior blade through an arc of 180°, makes it impossible for me to do ample justice to this instrument.

But those familiar with the Barton forceps claim the accidents mentioned do not occur. They are possibilities, however, that make it incumbent upon those learning the use of the Barton instrument to proceed cautiously.

All things considered, the child is unquestionably a better risk advancing by the head (through traction on forceps) than by the breech

(following version). Likewise, it will be conceded that, in the hands of the average operator, a head-advance that can be produced as deliberately as one chooses will continue to entail a lower fetal mortality than an advance by the breech (following version), that of necessity must be relatively rapid.

For these reasons, the question of efficient and safe forceps application in inlet arrest demands attention. The Barton forceps is suggested as a possible answer. The instrument certainly merits thorough investigation and exhaustive test.

But advance in inlet arrest is possible without making a choice between pelvic and oblique-cephalic application of conventional forceps or even without selection being made of one of the newer forceps that assures a perfect cephalic application. Delivery may be effected by internal podalic version and breech extraction.

Granted the "version" is truly elective in that it is done after maximum second-stage moulding, and granted, further, the operator has mastered the essentials of the Potter technic, delivery by version and extraction promises more in inlet arrest than does delivery by the vertex. At least I know that my own results, in terms of cervical laceration, asphyxia, and cerebral injury have improved by wider use of version and extraction in the type of case referred to.

What has just preceded is not intended as an appeal for the delivery of all high-arrested heads by version and extraction. Even less does it mean that the operator should learn version through repeated and unsupervised personal experience with cases so conducted. The beginner or the one with limited operative experience will unquestionably meet with lower mortality rates where arrest is met by a forceps-advance rather than by a breech extraction following version. There is no situation in practice that calls for more niceties in judgment and skill in execution than does delivery by "version and extraction"; and with this sentiment it is believed practically all obstetricians will be in accord.

At the same time, either "high forceps" or delivery by elective version and extraction is the procedure of choice in inlet arrest; and it remains for extended discussion to determine which. But, until such agreement has been arrived at, the full possibilities and the limitations of each must be taught.

Summarizing what has preceded, the following is offered in support of the contention that "none other than cephalic application should be taught."

A. In all medium and low forceps operations cephalic application is possible. It is acknowledged to be safe, occasioning the minimum of fetal injuries.

All "persistent posteriors" are deliverable by inverted cephalic application and the Scanzoni maneuver, or by single blade rotation and, secondary, true cephalic application as the alternative procedure.

Here, other than cephalic application is both unnecessary and unsafe.

Cephalic application is possible even in "deep transverse arrest of posteriors." Here, oblique-cephalic and pelvic applications are not only unsafe, they are scientifically unsound. What is needed in these cases is, primarily, rotation and, subsequently, advance. The presenting part is made to retrace its pathologic steps. It is made to recede to the level of the midpelvis where cephalic application is possible and, from which level, an uneventful advance can be effected.

Again, there is no occasion for considering other than cephalic application.

B. In high forceps operations cephalic application,—or at least a close approximation to it,—is always possible, provided the head rests in one or the other oblique. Accordingly this alone should be considered here.

With arrest in the transverse diameter of the inlet, three procedures are available:

First, an oblique application, persisted in only until the level of the high-midpelvis is reached, when true cephalic application can be made.

Second, perfect cephalic application, made possible by using either the Kjelland or the Barton forceps.

Third, delivery by version and extraction.

There would appear to be no place for pelvic application, while oblique-cephalic application meets the requirements of the rare case wherein a slight advance must be occasioned before perfect cephalic application is possible.

CONCLUSIONS

1. Cephalic application is scientifically sound; it is safe; and it is all-sufficient in that it is obtainable in practically every instance. For these reasons it is the only application that should be taught.

2. Pelvic application is mechanically inefficient; it is dangerous; and it is unnecessary. In the rare instances where it is the only application that seems possible, delivery should be effected by version and extraction. It should be mentioned only to be condemned.

3. Oblique-cephalic application, while it meets the mechanical needs of the occasional situation, is so apt to result in fetal head injuries that it is not entitled to be accorded the distinction of an essential (primary) application. Rather, let "oblique placing of the blades" be presented as an expedient, reluctantly but nevertheless necessarily employed to produce initial advance at the pelvic inlet.

4. The Kjelland and the Barton forceps merit thorough trials as means of effecting delivery with perfect cephalic application to high heads.

5. There is need for dispassioned consideration of the utility of internal podalic version and breech extraction in obviating the hazards of dangerous high forceps operations.

The obstetric forceps is something more than a mechanical means more or less reluctantly used,—too often with fetal and maternal injury,—to overcome the difficulties of obstructed labor. Rather, it is an instrument of precision, the proper use of which can be counted upon to lower the morbidity and the mortality that so often attend parturition; and what has gone before is offered as a contribution toward establishing it as such.

289 STATE STREET.

MATIN SLEEP

BY GEORGE F. CHANDLER, M.D., F.A.C.S., KINGSTON, N. Y.

MATIN sleep anesthesia is the name I have given to the method of routinely administering ten grains of luminal to adult patients between the hours of nine and twelve the night preceding an operation and followed with gas-ether at operation in the morning. Between the ages of twelve and twenty-one, five grains of luminal are given, and between the ages of five and ten, two grains.

In the morning the patients come to the operating room in a drowsy condition having slept the night through. In other words, it is a delightful morning sleep.

While hunting around for a descriptive name, the word *matin,* meaning morning was suggested to me. I began using this name and it is remarkable how readily it has been taken up by patients and nurses. In fact, in our part of the state, it has made as much of a hit with the lay people as the name "twilight sleep" did some years ago.

I do not claim to be the originator of giving luminal before anesthesia, for I understand that small doses of it have long been used in Germany three or four hours before local anesthesia and I have also found that several men in this country have been using luminal before general anesthesia as well as before local anesthesia in varying doses and at various hours preceding operation, but I do believe that the routine giving of ten grains of luminal twelve hours before operation (that is on the evening before) to produce a dreamy sleep on the morning of operation is a new procedure.

I first started using luminal at about six or seven o'clock the morning of the operation in large doses, going as high as fifteen grains. At about the time that I did this, I read an article by Willard Bartlett which appeared as an editorial in the April number of *Surgery, Gynecology and Obstetrics* in which he advocated even larger doses given three hours before gas-ether anesthesia. Another article of his has appeared since then in the same journal.

I tried his method but am satisfied that a large dose a few hours before operation is not so favorable to the patient nor does it achieve

so quiescent an after effect as when given the evening before. I also experimented with a divided ten grain dose, giving five at night and five in the morning of the operation. This method, too, I discarded.

After experimenting with these different methods of administration in over 160 cases, I have finally concluded that ten grains given anywhere from twelve to fifteen hours before operation is the ideal dose and the ideal time.

Surgery, as we know, has passed through many stages. Before the advent of ether and chloroform it was a brutal though necessary procedure. When I began giving ether in 1892, we used a cone made of newspaper and a towel pinned together with safety pins, one end of the cone being closed and stuffed with cotton into which the ether (not so pure) was poured. We then jammed this cone over the patient's face, everyone lent a hand in holding him down, and he was practically suffocated into unconsciousness. All the older men can well remember it being done this way in the larger hospitals of New York City. But, as in everything else, time and experience have brought refinements until now with the open cone method and gas-ether or ethylene administration by apparatus, the procedure has become almost perfect for the comfort of the patient and the convenience of the operator. In spite of all these advances there is still a mental hazard for the patient that must be considered in operating. I am sure that we do not give enough thought to this phase of the work.

People in the United States are today apparently in a more nervous state than formerly, particularly in matters concerning health. Radio talks, articles in newspapers written by physicians, the insidious advertising of the drug manufacturers, all have had their influence. Consequently, the thought of an operation seems to unbalance their nervous systems more than formerly. This condition must be recognized and given great consideration by a surgeon.

To us, surgery becomes routine. Nurses and doctors are more or less callous and cannot understand why anybody should feel worried about an operation. But for the patient there is a worry and a very decided one and this worry retards convalescence and should be considered of vital importance. I think that there is a mental hazard of from 10 to 25 per cent. This thing is not new. We have all recognized this and have used morphine, scopolamine, bromides and other drugs to overcome it. I am bringing to your attention now what I believe to be the best method that I have found to overcome this hazard of the mind.

After a diagnosis has been made in the office and the patient is told that an operation of election is necessary, he or she begins at once to be highly nervous even if never so before, and this condition obtains until the time of operation. Every surgeon recognizes this and at times gives sedatives to his patients to quiet them until they come to

the hospital. The admission to a hospital as a patient is a very momentous step to most people.

I now tell my patients that as soon as they shall have entered the hospital and are taken to their rooms, they will be given "some medicine" and will fall asleep at once, rest all night, and will not know or care when they are going to the operating room.

As soon as the patient has been put to bed, the nurse gives her ten grains of luminal mixed with a little elixir-lacto-peptine and within half an hour or an hour she is asleep and continues quietly through the night and can be prepared for operation early in the morning without becoming aroused.

The patient comes to the operating room in a care-free, somnolent state, will speak if spoken to, but if not disturbed, remains very drowsy. A few whiffs of gas are given and my ether records show that about one-third of the amount of ether formerly used is sufficient. The operation finished, the patient is returned to the room still quiet and peaceful. There is practically no nausea for very little ether has been given. For pain, a small amount of morphine is given, possibly $\frac{1}{8}$ grain and this seems to be enough. The patient then rests quietly all day, all through the night and usually through the next day.

On the third day she is as bright as a dollar, feels wonderful, and the convalescence is so much quicker and better than of old that those in the hospital who were skeptical at first are now all sold on this method.

The patients themselves are delighted. They remember little about the operation from the time they enter the hospital up until about the third day and then when they find out it is all over with so little suffering, they are in such an exalted state that they carry through, make a quick, sure recovery, and leave the hospital in a frame of mind that is very pleasing to all concerned.

I have tried nearly every kind of anesthesia in elective cases but now use luminal twelve hours before them all. I find it of great benefit preceding local anesthesia.

I have used spinal anesthesia, and while it is remarkably successful, still the nervous shock to the patient makes me hesitate to use it routinely. I am thoroughly convinced that patients do not convalesce as well following spinal anesthesia as they do after matin sleep. It is quite an ordeal for them to go through even though morphine has been given. They feel faint at times and want sips of water. The knowledge that they cannot move their legs worries them. They have to be talked to and some of them must be constantly reassured that everything is going well. They are conscious that they are being operated upon. They overhear any remark from the surgeon. They know how much time the operation requires and the mental impression is more or less lasting. I have talked with patients who have been operated

upon by excellent surgeons under spinal anesthesia and I find that most of them did not recover as quickly as I think they should. I have found this to be so in my own cases.

I admit that some patients are very much pleased with it but these I have found are invariably individuals of phlegmatic temperament, not at all emotional or excitable. Generally speaking, I would say that the surgeon who uses spinal anesthesia is more pleased with it than are the patients on whom he operates.

I have asked many doctors of my acquaintance if they would be willing to have spinal anesthesia used upon themselves and have heard only two say that they would, though many of them employ it.

Luminal, which is known chemically as phenyl-ethyl-mal-on-ylurea, is a member of the barbituric acid series of hypnotics, the first of which, veronal, was discovered by Emil Fischer and Joseph von Mering in 1904. By most authors luminal is considered the most powerful of the barbituric acid hypnotics.

The pharmacology of luminal-sodium was first studied by Dr. E. Impens in 1912. As in natural sleep, the hypnotic action of luminal has been found to be accompanied by a reduction in blood pressure and pulse rate.

Prolonged use of luminal or luminal-sodium in small doses or the administration of large doses over a shorter period may cause untoward symptoms, particularly in hypersusceptible persons. The most frequent reaction recorded in the literature is a cutaneous eruption resembling measles, scarlet fever or urticaria, usually attributed to an idiosyncrasy, but possibly related to the cutaneous vasodilatation produced by luminal. As a rule, this disappears spontaneously or after the discontinuance of the drug or reduction of the dose. It apparently occurs in from 1 to 3 per cent of patients, Grinker having observed a rash in 6 of 200 patients, Sexauer and Bell in 2 of 400, and Rowe in 1 of 56 epileptics, who received the drug every day morning and night. Under the use of the larger doses, 5 grains or more, relatively prolonged drowsiness may be observed and occasionally there are vertigo, headache, and nausea. Delirium, stupor, and ataxia may result from continuous use of excessive amounts.

A comprehensive review of the literature by Gruber, Shackelford and Ecklund disclosed only four possible deaths from luminal which these authors state were probably not wholly due to the drug but to other causes. One of the patients took 154 grains and another 308 grains of luminal with $\frac{1}{3}$ oz. tincture of opium for suicidal purposes. These authors conclude that luminal is not atoxic but that it is relatively nontoxic when given properly, the range between the therapeutic and toxic doses being large. Patients have taken more than 50 grains of luminal in a single dose without fatal results. McNerthney

reported a case of an epileptic woman who took 75 grains in an insane moment, slept for eighty hours, and recovered fully thereafter.

I saw one patient who took 70 grains for suicidal purposes. He slept for forty hours with no bad effects.

To sum up: matin sleep eliminates the mental hazard. It allays the preliminary worry, puts the patient absolutely and securely at ease during that first dreadful night of anxiety. Going to the operating room is of no importance to him. The use of only about one-third the usual amount of ether is necessary. Since so little ether is used, there is practically no vomiting. Very little morphine is necessary—sometimes none at all, so there is no blocking up of elimination. Patients are quiescent for two days following the operation. The time passes quickly for them and the convalescence is more pleasant. Finally, the· operation has been performed with no apparent mental shock.

11 EAST CHESTNUT STREET.

Sakuma, H.: Experimental Study on the Excretory Function of the Uterine Mucosa. Part III. Biological Observation. Japanese J. Obst. & Gynec. 11: 112, 1928.

The author performed the following experiments: He injected colloidal iron, colloidal silver, mercury, lead, phosphorus, nicotine, arsenic, and potassium iodid into rabbits. Then 0.2 to 0.3 c.c. of the secretion of the uterine mucosa were obtained from these animals and spermatoza were mixed with the endometrial secretion. In the secretion of normal rabbits spermatozoa showed a great decrease in their activity in four to six hours and their activity ceased entirely after eleven and one-fourth hours. Spermatozoa were found to survive longer than this in 0.7 per cent saline solution. In the endometrial secretion of animals given hydrochloric acid, or olive oil or injections of potassium iodid, the activity of spermatozoa persisted as long as in the secretion of untreated animals. The life of the spermatozoa was very greatly shortened, however, by being mixed with the uterine secretions from rabbits to which lead, nicotine, and yellow phosphorus had been administered. The author also studied the effect of the injection of the substances above mentioned on the fertility of rabbits. He found that in normal rabbits the incidence of pregnancy was 70 per cent and the incidence of abortion and premature labor was 14.2 per cent. In the rabbits treated with lead, pregnancies occurred in only 40 per cent and every animal aborted. In those treated with yellow phosphorus only 20 per cent became pregnant and likewise all aborted, and in the rabbits treated with nicotine 40 per cent became pregnant and 25 per cent had abortions.

J. P. GREENHILL.

REPORT OF THE COMMITTEE ON MATERNAL WELFARE, OF THE AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLOGISTS, AND ABDOMINAL SURGEONS

IN SUBMITTING this report for 1930, the committee has studied more particularly the vital statistic tables of the United States and has briefly alluded to some good work done on this important subject in Canada and England.

In the registration area of the United States, the figures so far available for 1929 show no reduction, or at best very little, in the death rate seen from all puerperal causes, notwithstanding the efforts and labors of various Bureaus of all sorts and kinds. The mortality in the United States in 1927 was 2.5 per cent per 1000 for living babies, the same figures as were seen in 1928 and one-tenth per cent higher than it was for the years 1924, 1925, and 1926; and the final figures for 1928 as compared with 1927 show eighteen states with a higher death rate from puerperal septicemia, sixteen with a lower rate, and six with the same death rate, while four states still remain out and unrecorded of our total forty-eight states.

The mortality from causes other than septicemia increased (as shown in the final report of 1928 for the registration area) to 4.4 for live babies, as compared with 4.0 in 1927, which year showed the highest death rate from such causes since 1920.

In twenty-three states, the death rate from puerperal septicemia was higher in 1928 than it was in 1927; it was lower in fourteen states and in three it remained the same.

The 1928 table for all puerperal causes other than septicemia in the cities in the registration area was 4.6 as compared with 4.2 per 1000 live babies for the rural parts of the area and for septicemia 3.1 and 2.0, respectively.

Canada's maternal death rate for the past three years has remained stationary at 5.6 per 1000 live babies, according to published reports.

In May of this year the United States Public Health Service inaugurated a current state mortality report system and published in the weekly Public Health Reports a table of specific mortality rates for each state for a period covering as many months of the current calendar year as were available to the date of publication, with comparative rates for the same period of the three preceding calendar years. Maternal mortality rates are included and fortunately the August report begins to cite the rates per 1,000 live babies rather than per 100,000 population as did the first tables, and statements that are made by the various states should serve as a stimulant for public health officials and obstetricians in their joint efforts to reduce the maternal death rate. To illustrate, Iowa, from January to May of this year shows a rate of 7.4 compared with the much too high rates of 6.7 and 6.6 for the same period of the two preceding years, and Kansas has a rate of 9.2 compared with 7.1 and 8.8 of the previous years, with the state of New York, exclusive of New York City, showing rates of 6.1, 6.1, 7.5, and 6.6 for the same period in 1930 and the three preceding years.

Dr. Henry Bixby Hemenway, Medical Registrar of the Illinois State Department of Health, at the annual meeting of the American Public Health Association last October, strongly renewed the plea for the method of using the divisor in obtaining rates, not live babies alone but live and stillbirths. For many years the New York State Health Department has figured maternal death rates as per 1,000 live and stillbirths. The Bureau of the Census, on the other hand, uses as the divisor the

number of live births in figuring rates for the registration area. Dr. Hemenway presents a strong argument for his preference of the divisor including both still and live births in his statements that practically no death included under the cause, *Accidents of Pregnancy* (No. 143), is connected with a living birth, that deaths from eclampsia, septicemia, and a goodly proportion of other maternal deaths are associated with stillbirths. With the true maternal death rate risk properly based on the total number of pregnancies, which is not accurately obtainable under the general report system in any state or country, the next closest total, that of still and live births, would seem the logical divisor. The variation in reporting of stillbirths in respect to months of gestation vitiates to a certain degree, however, the stillbirth count. Canada has recently published a study of maternal death rates figured with three divisors, live births only, still and live births, and total confinements. The three rates were 5.78, 5.58, and 5.65 respectively. State rates figured by Dr. Hemenway show a similarly slight variation. The adoption of the most accurately registered divisor for the standard would, therefore, seem to be the course indicated, rather than a struggle to register total confinements.

A number of special studies have been undertaken during the year to determine why the high maternal death rate continues despite the many efforts which have been made to reduce it.

The New York Academy of Medicine is carrying on a three-year study of the cause of death of every woman who dies during or after pregnancy and at childbirth. This study is very exhaustive and will probably bring out more definite information than any of the preceding studies of a like character. However, no results are yet available.

In Wisconsin, a special study was made by Calvert of the maternal deaths, 766 in number, in the years 1927 and 1928. Of these deaths, 632 were due primarily to puerperal causes and 60 per cent followed surgical procedures with 20 per cent of all of the operations being cesarean sections, while 13 per cent of all of the maternal deaths followed cesarean sections. One-third of the women were primipara and 45 per cent of the group were under thirty years of age. Septicemia was the most frequent cause of death and included one-third of all of the deaths. Eclampsia came second with one-fourth of all of the deaths. Of the septic deaths 35.3 per cent followed septic abortions, criminal or self-induced. Forty-four per cent of these women had no prenatal care.

For two years past the New York State Department of Health has been endeavoring to tabulate the answers on 697 questionnaires filled in by physicians as to the cause of maternal deaths given in greater detail than on death certificates. One is startled to read that of these cases only partially studied, only thirteen women had been in the hands of a physician during the whole nine-months' period of gestation, while 50 per cent were in the hands of a physician for one week or less. Four hundred and eight answers were given concerning prenatal care, of which 65 per cent had noted such care while 41 per cent of the total did not answer this question at all. The reports from the State Health Department indicate that these tabulations will soon be completed.

Sir Arthur Newsholme makes a very interesting report of the maternal deaths in the London East Side Maternity Hospital, in which he has studied the maternal deaths for the years 1884-1928 inclusive.

In the year 1927-1928 this hospital, with a bed capacity of 56, had 2,517 confinements in the hospital, while 1,608 confinements were cared for by the staff members in the patients' homes. There were three maternal deaths in the hospital group while there were no deaths at all in the patients' homes. This may have been due to the fact that the more difficult cases were taken to the hospital, rather than that better technic was followed in the homes. Sir Arthur compares this rate of 1.19 per 1,000 live births for the institution with that of 3.09 in the entire

metropolitan area, and decides that there must have been better work in the institution, because, while the hospital cases were mostly those of births after the seventh or eighth months of pregnancy, those in the metropolitan area covered all stages of pregnancy. However, this will not explain the difference, as it is well known that the maternal deaths before the seventh month of gestation are small in number. When this discrepancy is estimated, the fact still remains that the maternal death rate in the cases in the institutions is only one-third that of the entire urban area and one-third as high as that of "Poplar," the neighborhood from which most of the patients come. There is a somewhat similar condition in relation to the death rate for stillbirth and live births, both of which are lower than those for the entire area. In 1928, 43 per cent of the mothers who died were primipara. Supervision in this hospital begins in the sixth or seventh month and is continuous thereafter. The women come regularly for examination and nurses pay weekly visits to the homes to see that instructions and laboratory examinations are carried out. This careful supervision during pregnancy is evidenced by the fact that there has been no death from eclampsia since 1919, although 20,000 women have been delivered and only one slight case of eclampsia has developed in the last 8,000 patients. In England, of course, a very large number of the deliveries are carried on by highly trained nurse midwives who have physicians always on call. A record like the one above quoted certainly makes one pause and realize what can be done. However, in our opinion some other elements must enter into causes of eclampsia, because eclampsia seems to occur in waves; in some years we see many cases even though patients have care during pregnancy, while in other years there are not any.

Louis Dublin gives a preliminary report of a study which was made jointly by a Maternity Center Association and the Metropolitan Life Insurance Company. (See this Journal, December issue, 1930.)

A number of committees representing this Association, the American Medical Association, and kindred agencies are working on the practical problem of increasing the efficiency of collegiate training in obstetrics. There seems to be a general consensus of opinion that more practical work in obstetrics is essential and that the number of hours spent in classroom and clinical work must more nearly approximate those spent on medicine and surgery. Apparently only progress reports have been made during the current year.

President Hoover's White House Conference should bring forth the very last word in relation to the whole subject of maternal welfare, because in its Division on Children's Health, an investigation is being made by the questionnaire method. The questionnaire has been widely circulated and is sufficiently intensive to furnish a variety of facts if the individual doctor takes time to study and answer the questions fully. This information will not be available before the middle of November.

Dr. L. A. Calkins of your own committee reports that a nine weeks' postgraduate course in obstetrics, in East Oklahoma was given this year, during May and June, and that he gave a similar nine weeks' course in western Kansas during June and July. The program for these circuit courses in Kansas and Oklahoma is to be carried out for the next four or five years, eventually covering the entire states. Dr. Calkins suggests that it would be well for the Association to urge that obstetric teaching should be included in training courses now being carried on in Wisconsin, North Carolina, and Georgia. In this connection it may be stated that the Federal Children's Bureau during the last year has sent Dr. McCord of Atlanta to conduct a series of institutes on maternity care for the rural physicians of Georgia.

Another plan considered in New York City is that for developing a center for training in midwifery. This course in the beginning is to be for graduate nurses

who will be fitted for the practice of midwifery in rural communities and as mid-wife supervisors. This activity is to be in charge of a committee for the Promotion and Standardization of Midwifery, of which Dr. George Kosmak, one of our Fellows, is among the incorporators.

It would seem that some cognizance of the birth control movement which is growing steadily in popularity could well be taken up by this Association. A recent volume on *Seventy Birth Control Clinics* by Caroline Hadley Robinson, published under the auspices of the National Committee on Maternal Health, with an introduction by Dr. Robert Latou Dickenson, raises the whole subject out of the realm of the sensational or emotional, with which it has so often been associated, and places it on the plane of a rational, scientific undertaking. With such men as Dr. Kosmak and Dr. Dickinson on the National Committee, as well as numerous others, it would seem that this Association could afford to have a definite policy in relation to the whole movement which would be of great assistance. There is little doubt today that a properly run birth control clinic, under the guidance of the best medical men in a given community would be an asset in many ways.

A wonderful opportunity for education on maternal welfare could be obtained through the use of the Parent-Teachers' Association groups, throughout the country, by the members of this Association. This national organization reaches into the very small places and is organizing more study groups in places of all sizes. A request to place the discussion of this subject on these thousands of programs, as sent out by them on the subject of maternal welfare, if conducted by competent men, would bring about an enormous amount of publicity which would reach mothers of all ages. These women are rapidly becoming intelligently articulate in their communities and care during pregnancy could be very materially increased by such a plan.

An interesting side light has been thrown several times lately upon the question of maternal welfare by the invasion of this field by the lay woman, through the medium of the popular magazine. One such discussion by Constance L. Todd, published in the *Ladies' Home Journal*, gives a history of the growth of the use of the Gwathmey method of synergistic analgesia. This is not a superficial article written by a tyro but is the work of a woman who has been so engrossed in the idea of relieving women of the pains of childbirth that she has gone into hospitals all over the country, talked with obstetricians, dug into hospital files, and is about to publish a book upon the results of her studies. When one considers the enormous circulation which this magazine enjoys, together with the fact that the author reports some 5800 cases in which the method has been used in the New York Lying-In Hospital, in which 85 per cent of the patients had almost complete relief from pain, as well as the fact that after quoting experiences of a similar type from Chicago, Madison, Cincinnati, Pittsburgh, and Philadelphia, together with Ottawa and Montreal, she concludes the article with a challenge to women to demand that their obstetricians look into the matter and see if it is not possible to give them well, live babies after normal deliveries without surgical interference, and practically without pain, one realizes such a woman may have a great deal of influence, good or bad as the case may be.

Dr. Helen Mac Murchy reports that the educational work for maternal welfare in Canada has been carried further by the publication of a new edition of the *Canadian Mother's Book* which contains additional educational material. This little booklet goes to mothers throughout the Dominion and carries the message of Canada's maternal and infant death rates. The material is set forth with great skill because of its simplicity and practical application while, at the same time, it tells the statistical story. The interest in the whole subject is reported to have increased throughout this year.

A. That the Committee on Maternal Welfare go on record as urging the Association to use its influence in helping to promote the collection and standardization of vital statistics to the end that comparable and specific maternal death rates shall be available with the greatest possible accuracy as to the cause of death, because of the well-known absence of accurate detailed information upon these death certificates.

B. The following recommendations are from Dr. Cooke, a member of your committee.

1. A concerted effort to train the student to proper obstetric thinking and conscience in a way which will endure after his graduation; this to be accomplished by giving an adequate amount of time to obstetric teaching, realizing that in general practice a knowledge of obstetrics is more necessary than a knowledge of surgery and equally necessary with a knowledge of medicine.

2. In teaching where time is limited, such as in the schools which train general practitioners primarily, concentrated attention should be given to the essentials, and particularly to thorough, supervised mannikin practice.

3. The clinical teaching of obstetrics should be real teaching, and · not merely the half-supervised conduct of more or less normal cases, which is customary at present. A competent instructor and students should be with the patient from the onset of labor until its termination. Prenatal and postnatal care should be thoroughly drilled into students in the out-patient departments. It would be preferable to have each patient handled by the same student from her first visit to the prenatal clinic until she is discharged from the follow-up service.

4. Careful study of hospital conditions in regard to obstetrics should be made. The present survey being carried out by the White House Conference is excellent, but it seems to me not to cover certain important points, of which I may mention the following:

a) In the questionnaire regarding causes of maternal and fetal death, there may be quite an error in the interpretation of the statistics obtained, through the requirement that fetal deaths be listed as following various specified operations; whereas, in fact (certainly this is true in our hospitals) a number of fetal deaths occur from causes not at all connected with the method of delivery.

b) In the survey it would have been very valuable to ascertain just what difference, if any, existed between the practice of teachers of and specialists in obstetrics as compared with that of other practitioners in the same hospital. In every hospital survey so far published, and in several surveys which I have made myself, this difference has been extremely marked.

5. The effort should be continued (although I am afraid this will prove as futile in the future as in the past) to educate the average practitioner in the proper conduct of obstetric practice, through the reading of papers, etc.

6. It is my opinion that conditions would be wonderfully improved if the system of medical education were rationally altered to meet changed conditions as regards specialization at the present time. My idea is quite similar to that which has been put into effect by the Mayo Foundation of Minnesota:

a) That undergraduate students should be thoroughly trained in those subjects which are primarily of value to the general practitioner: medicine, obstetrics, minor surgery and gynecology, and the early diagnosis of major gynecologic, surgical, and other diseases. On the completion of this course and a year's rotating internship, the student may be given the degree of M.D., and be legally qualified as a general practitioner, with a definite legal limitation as to the types of major work which he might practice (due allowance being made for emergencies).

b) The holder of the M.D. degree would be eligible for a postgraduate course of at least three years, in which he would be thoroughly drilled in the minutiae of the

speciality which he elected, from both the theoretic and the practical point of view. Thorough training in pathology and research methods should be given during this course. This course would best be given while the student served as a resident in his specialty in the teaching hospital. On the completion of this course he would receive some such degree as Master of Science in Obstetrics, Surgery, etc., and would be legally qualified as a specialist.

Such a plan would provide the public with a general practitioner much better trained for the character of work which he would be capable of performing, and would insure that a specialist really was deserving of the name, having had at least a barely adequate training for the purpose.

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IRVING W. POTTER, M.D., Chairman.
WILLARD R. COOKE, M.D.
L. A. CALKINS, M.D.

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Lane-Roberts, C. S.: Abdominal Pain in Pregnancy. Lancet 2: 1288, 1928.

The author states that there may be continuous or intermittent abdominal pain in pregnancy. Not infrequently positive physical signs are absent. The severity may vary from a mild discomfort to a marked distress. Abdominal supports may relieve or may aggravate the condition. Gradual stretching of the uterus, stretching of the round ligaments, constipation, flatulence, toxemia, and fetal movements are some of the causes of pain.

The commoner organic causes are divided into three groups in which the condition is confined: (1) to the uterus; (2) to the adnexa, (3) and to associated conditions. Undue stretching of the uterus as in hydramnios, multiple pregnancies, and hydatidiform mole are very likely to produce pain. All types of fibromyomas with their possible changes and mechanical interferences may distress the patient. Likewise, concealed hemorrhage and rupture of the uterus manifest themselves by pain.

Ectopic pregnancy most commonly produces pain at the time of rupture. "Salpingitis and salphingo-oophoritis rarely light up in pregnancy." Ovarian tumors generally produce distress because of pressure, torsion, or degeneration.

Of the associated conditions pyelitis, acute appendicitis, intestinal obstruction, retroverted uterus, gall bladder complications, pneumonia, calculi, and suppurative pelvic peritonitis are possible causes of abdominal pain.

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H. C. HESSELTINE.

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Item

American Board of Obstetricians and Gynecologists

Formally organized in September, 1930, the Board has now issued certificates to the group of physicians whose names are published herewith. The first examination for candidates is to be held March 14, 1931. The men whose names appear below have been granted certification upon the basis of their attainments. This distinguished list is an index therefore of the importance which the functions of the Board have assumed in the minds of some of the eminent obstetricians and gynecologists of this country and Canada since each man whose name appears on this list was considered individually by the entire Board and had made personal application for certification. Undoubtedly there are many others whom the Committee on Credentials would recommend to the Board for classification in Group I for a certificate to be granted without examination and the Secretary, Doctor Paul Titus, 1015 Highland Building, Pittsburgh, Pennsylvania, will be glad to receive applications from these men. The JOURNAL will publish the accessions to the list of certified physicians as these are received from the Secretary.

ADAIR, FRED L.	CHICAGO, ILLINOIS
AINLEY, FRANK C.	LOS ANGELES, CALIF.
ANSPACH, BROOKE M.	PHILADELPHIA, PA.
AYRES, DANIEL R.	NEW YORK CITY
BAER, JOSEPH L.	CHICAGO, ILLINOIS
BARRY, LEE W.	ST. PAUL, MINN.
BILL, A. H.	CLEVELAND, OHIO
BISHOP, ELLIOT	BROOKLYN, N. Y.
BLAND, P. B.	PHILADELPHIA, PA.
BLOOMFIELD, J. H.	CHICAGO, ILLINOIS
BLOSS, J. R.	HUNTINGTON, WEST VA.
CALDWELL, W. E.	NEW YORK CITY
CALKINS, L. A.	KANSAS CITY, KANSAS
CARY, EUGENE	CHICAGO, ILLINOIS
CHALFANT, SIDNEY A.	PITTSBURGH, PA.
CLELAND, F. A.	TORONTO, CANADA
COOKE, W. R.	GALVESTON, TEXAS
CORSCADEN, J. A.	NEW YORK CITY
CREADICK, A. N.	NEW HAVEN, CONN.
CUMMINGS, H. H.	ANN ARBOR, MICHIGAN
CHERRY, THOMAS H.	NEW YORK CITY

DANFORTH, W. C.	EVANSTON, ILLINOIS
DANNREUTHER, WALTER T.	NEW YORK CITY
DAVIS, C. H.	MILWAUKEE, WIS.
DeLEE, J. B.	CHICAGO, ILLINOIS
DeNORMANDIE, R. L.	BOSTON, MASS.
EHRENFEST, HUGO	ST. LOUIS, MO.
EMGE, L. A.	SAN FRANCISCO, CALIF.
FALLS, F. H.	CHICAGO, ILLINOIS
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FINDLEY, PALMER	OMAHA, NEB.
FISHER, JOHN M.	PHILADELPHIA, PA.
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FRANK, R. T.	NEW YORK CITY
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GALLOWAY, C. E.	EVANSTON, ILLINOIS
GARNETT, A. Y. P.	WASHINGTON, D. C.
GEIST, SAMUEL H.	NEW YORK CITY
GILLIS, R. A. D.	PITTSBURGH, PA.
GOFF, BYRON H.	NEW YORK CITY
GOLDSBOROUGH, F. C.	BUFFALO, N. Y.
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ILL, E. J.	NEWARK, N. J.
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LEIGHTON, A. P.	PORTLAND, MAINE
LITTLE, H. M.	MONTREAL, CANADA
LITZENBERG, JENNINGS C.	MINNEAPOLIS, MINN.
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MAZER, CHARLES	PHILADELPHIA, PA.
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McCUSKER, C. J.	PORTLAND, OREGON
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MILLER, HILLIARD E.	NEW ORLEANS, LA.
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NOVAK, EMIL	BALTIMORE, MD.
PARKE, WM. E.	PHILADELPHIA, PA.
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PHANEUF, LOUIS E.	BOSTON, MASS.
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QUIGLEY, J. K.	ROCHESTER, N. Y.

REED, CHARLES B.	CHICAGO, ILLINOIS
RONGY, A. J.	NEW YORK CITY
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SCOTT, R. A.	EVANSTON, ILLINOIS
SCHUMANN, E. A.	PHILADELPHIA, PA.
SCHWARZ, O. H.	ST. LOUIS, MO.
SEELEY, W. F.	DETROIT, MICHIGAN
SIMON, LUDWIG S.	CHICAGO, ILLINOIS
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STEIN, ARTHUR	NEW YORK CITY
STEIN, IRVING F.	CHICAGO, ILLINOIS
STEPHENSON, H. A.	SAN FRANCISCO, CALIF.
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TAUSSIG, F. J.	ST. LOUIS, MO.
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VAUX, NORRIS W.	PHILADELPHIA, PA.
WARD, GEORGE G.	NEW YORK CITY
WARD, WILBUR	NEW YORK CITY
WATSON, B. P.	NEW YORK CITY
WELTON, T. S.	BROOKLYN, N. Y.
WILLIAMS, J. WHITRIDGE	BALTIMORE, MD.
WILLIAMSON, HERVEY C.	NEW YORK CITY
WING, LUCIUS A.	NEW YORK CITY
WILLIAMS, PHILIP F.	PHILADELPHIA, PA.
YATES, H. W.	DETROIT, MICHIGAN

Books Received

BEHAVIOR OF THE NEWBORN INFANT. By Karl Chapman Pratt, Amalie Kraushaar Nelson, and Kuo Hua Sun. The Ohio State University Press, Columbus, 1930.

CHILD ADJUSTMENT, in relation to growth and development. By Annie Dolman Inskeep, Ph.D. D. Appleton & Co., New York, 1930.

FARM CHILDREN. By Bird T. Baldwin, Eva Abigail Filmore and Lora Hadley, of the Iowa Child Welfare Research Station. D. Appleton & Co., New York, 1930.

THE CREED OF A BIOLOGIST. By Alfred Scott Warthin, professor of pathology, and director of the pathologic laboratories in the University of Michigan, Ann Arbor. Paul B. Hoeber, New York, 1930.

IDEAL MARRIAGE. Its Physiology and Technique. By Th. H. Van de Velde, formerly director of the gynecologic clinic in Haarlem. Translated by Stella Browne. Covici-Friede, Publishers, New York, 1930.

STOECKEL'S HANDBUCH DER GYNAEKOLOGIE. Dritte, neubearbeitete und erweiterte Auflage. Fuenfter Band, zweite Haelfte. Die Erkrankungen der Scheide, bearbeitet von Professor Dr. Ludwig Nuernberger, Universitaetsfrauenklinik in Halle. Mit 271 zum Teil farbigen Abbildungen im Text. Verlag von J. F. Bergmann, Muenchen, 1930.

MEDICAL REPORT FOR THE YEAR 1929. Glasgow Royal Maternity and Women's Hospital, Glasgow, 1930.

THERAPIE DER KOMPLIZIERTEN SCHWANGERSCHAFT. Von Professor Dr. Th. von Jaschke, Universitaetsfrauenklinik Giessen. Georg Thieme, Leipzig, 1930.

BLUTUNGEN UND FLUOR. Von Professor Dr. Hans Runge, Universitaetsfrauenklinik in Kiel. Mit 18 Abbildungen. Verlag von Theodor Steinkopff, Leipzig, 1930.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. Eighteenth Series. The Rockefeller Foundation, New York, 1930.

TEXTBOOK OF GYNECOLOGY. By Arthur Hale Curtis, professor and head of department of obstetrics and gynecology, Northwestern University Medical School, etc., etc. With 222 original illustrations. W. B. Saunders Company, Philadelphia, 1930.

American Journal of Obstetrics and Gynecology

Original Communications

CERTAIN NEW OBSERVATIONS ON THE ACTION OF THE ANTERIOR PITUITARY*

By L. KRAUL, M.D., BALTIMORE, MD.

(Docent for Obstetrics and Gynecology at the University of Vienna)

AT THE present writing there is no doubt that the anterior lobe of the pituitary gland promotes the growth of follicles and thereby the production of the female sex hormone in the ovary. This knowledge is the result of the investigations of Long and Evans, Smith and Engle, Zondek and Aschheim. These authors showed that the implantation of anterior pituitary substance induces the maturation of follicles, while administration of its extract causes luteinization. Whether the antagonistic effects upon the ovaries of immature animals are due to two different hormones, or to varying quantities of a single hormone, is not quite clear. Nevertheless the majority of these authors hold the first point of view: Evans and Long distinguishing a sex hormone and a growth hormone, Zondek and Aschheim a prolan A and B, and Crew and Wiesner a rho I and a rho II. However, these several substances were produced as chemical extracts by rather complicated methods, while little attention was paid to the fact that the implantation of pure hypophyseal tissue might also produce similar effects.

We already know that the anterior lobe of the pituitary may be influenced by many factors, mainly in connection with the sex organs. Erdheim and Stumme have described the typical changes in pregnancy, and Fischera, Luziani, Marassani those following castration and occurring during menopause. Berblinger, Adachi, Lehmann, Baniecki have shown that both placental substance and ovarian hor-

*From the Department of Obstetrics, the Johns Hopkins Hospital and University.

mone cause histologic alterations in the anterior pituitary quite similar to those in pregnancy. Furthermore that after castration, the gland can be restored to its former state by administration of folliculin. Aschheim and Zondek drew attention to the tremendous increase of anterior pituitary hormone in the blood, as well as in the urine, just after the onset of the pregnancy, and particularly in cases of hydatidiform mole and chorionepithelioma. B. Zondek also demonstrated that great quantities of prolan A were secreted in the urine after castration or early in the menopause. The same occurs in connection with malignant tumors, chiefly of the generative system, and as reported by MacCallum and Fabyan, Schilder, Schultze and Zuckermann, pregnancy-like changes in the tissue of the anterior pituitary in the thyroaplasia. On the other hand, Wagner has reported a case of a tumor in the anterior pituitary associated with tremendous luteinization of both ovaries. Berblinger found that he could produce changes in the anterior pituitary like those of pregnancy by peptone injections, and Baniecki made similar observations after the injection of the urine of pregnant women and of horse serum. Therefore Berblinger, as well as Karlefoss and Muth, consider that changes noted in the anterior pituitary in malignancy and pregnancy are due to protein bodies. H. Zondek has formulated a so-called "periphery theory," and believes that any bodily event may influence the entire organism, even the hypophysis. This, indeed, is quite probable, in the light of what we know concerning the mutual interaction of the endocrine tissues of the organism.

According to Evans and Simpson the anterior pituitary of gonadectomized animals has been found more effective than in normal animals. Following the same authors, the male gland shows an increased potency in comparison with the female. Furthermore, they could not find an increased action of the anterior pituitary of pregnant animals. Finally the same authors state exactly that the implantation of hypophyseal tissue is more effective than the injection of an extract, made of the urine of pregnant women.

Methods.—In view of the above findings, we desired to ascertain, if possible, by biologic assay, whether or not there are any differences in the effects of implanted anterior pituitary glands which had been exposed, before transplantation, to any of the following conditions: (A) Daily administration of placental tissue, as well as to extracts made from it. (B) To corpus luteum extract. (C) To folliculin. (D) To urine from pregnant women. (E) Finally to adrenalin injections. We wished to learn the effect of the pituitary gland removed from animals after operative or x-ray castration, as compared to the effect of the irradiated gland. I desired to see the effect of the anterior pituitary of pregnant animals as compared with nonpregnant ones, particularly because E. Philipp had reported that he obtained negative results in

immature miee with implantation of hypophyses taken from women during or immediately after gestation. I used immature miee fourteen to twenty-four days old for the tests, litter-mate animals being used as eontrols. Though I intended to investigate only the qualitative differenees in the effeet on the ovary, I noted quantitative differenees as well. The whole gland was employed throughout my experiments, sinee by ineluding the posterior portion, I felt, that I would introduee less error than by the loss of substanee ineident to disseeting out the anterior lobe.

Results.—In group A the implants were taken from four rabbits whieh had reeeived daily injeetions of plaeental extraet over a period of six days. My extraet was prepared from human plaeenta at term by the aleohol, ether, and aeetone method of Corner. I found that

Fig. 1.—Ovary of mouse, three weeks old, six days after implantation of anterior pituitary of a female rabbit previously injected with placental extract.

sueh implants produeed ehanges in the ovaries of immature miee eonsiderably different from those deseribed by Smith and Engle, who used normal glands. In my experiments the ovaries showed an inerease in size and weight, a preponderanee of lutein tissue and many pseudoeorpora atretiea. The granulosa lutein eells eompletely filled the lumina of the follieles and imprisoned the degenerating ova. On the other hand some of the follieles showed an unmistakable tendeney toward development. The ovaries were quite eongested as evideneed by enlarged and engorged eapillaries, while an oeeasional hemorrhage was seen in the stroma outside the vessels proper. The vaginal smear rarely showed eornified eells exelusively, but rather a mixture of eornified and nueleated epithelial eells.

I used Corner's method for extraeting the plaeenta, partieularly to determine if this tissue eontains eorpus luteum hormone, as it is gen-

erally conceded that the placenta assumes the function of the yellow body after the latter degenerates. I injected this extract into female rabbits, which had previously been ovarectomized, eighteen hours after copulation, and in their uteri five days later I could find no growth of the mucous membrane; from which it may be deduced that the human placenta at term contains no corpus luteum hormone. On the contrary, the extract has been found to contain large amounts of folliculin, as tested on both castrated and immature mice. I shall make further reference to the effect of folliculin on ovaries of mature animals in connection with studies upon the corpus luteum hormone and the urine of pregnancy.

In the placental implantations I inserted the whole placental disc of guinea pigs and rats under the fascia in the backs of four rabbits,

Fig. 2.—Ovary of three weeks' mouse, six days after implantation of one pituitary gland of a female rabbit previously implanted with five discs of guinea pig placenta.

making five such implantations in two weeks. At the end of that time the hypophysis of the rabbits was removed and placed in the thigh muscles of immature mice, which were killed six days later. Their ovaries showed a high degree of development, and the vaginal smear disclosed only cornified epithelium. On section, the ovaries contained one or several mature graafian follicles at the point of rupture, and their development seemed more pronounced than in animals treated with glands prepared by an extract of human placenta. In this connection one must take into consideration the fact that the placenta of the guinea pig and rat has been found to be relatively poor in folliculin, and that the implantation of placental tissue introduces the factor of parenteral protein effect. While some of the follicles are undergoing a cystic change, several pseudocorpora are to be found in

the ovaries. Finally, the effect of the anterior pituitary seems to be increased by the placental implants. Both the follicular maturation and the luteinization are increased simultaneously, but neither appears to be predominant. This is in contrast with the result obtained after implantations of gland prepared by placental extract. The latter causes chiefly, as mentioned above, luteinization, whereas the gland prepared by the whole placenta seems to yield an increase of both anterior lobe principles.

In group B I extracted yellow bodies of pigs by Corner's method with alcohol, ether, and acetone, and the extract so prepared appeared to have the same properties as one kindly sent me by Dr. Corner. In this series of experiments, I sometimes implanted fresh corpus luteum tissue directly, and at other times I injected the extract into three

Fig. 3.—Ovary of mouse, three weeks old, six days after implantation of three pituitaries of adult mice previously injected with corpus luteum hormone.

rabbits, five guinea pigs, five rats, and six mice over varying periods. The hypophyses of these animals were then implanted into immature mice. The ovaries of the latter showed a definite stimulation of lutein tissue; many pseudocorpora filled the tiny ovaries, which were really smaller than the average immature ovary stimulated by anterior pituitary implants. The development of follicles is not completely inhibited, but it is distinctly diminished. The vaginal smear has never shown signs of estrus, only cornified cells mixed with leucocytes and nucleated epithelial cells being formed.

In group C I prepared the hypophyses of three rabbits, five guinea pigs, and six mice by injections of "Amniotin, Squibb," containing female sex hormone. These hypophyses were then implanted into immature mice, whose ovaries became quite mature after six days. They

show large graafian follieles alternating with great pseudocorpora in about equal numbers. The ovaries are very eongested, but there is no hemorrhage in the interior of the follicles. The changes resemble those produced by the pituitaries of animals treated with plaeental tissue (group A). In other words, a marked anterior pituitary effect is observed in both its phases, namely, maturation and luteinization of follicles. The number of follicles undergoing luteinization is evidently greater than after implantation of a normal anterior pituitary body.

In group D we used the pituitary glands of five rabbits and six guinea pigs whieh had been injected with urine from women in the various months of pregnaney and during the puerperal state. Some of the animals reeeived daily injeetions of two to five c.e. over a period

Fig. 4.—Ovary of three weeks' mouse, six days after implantation of three pituitaries of adult mice previously injected with Amniotin, Squibb.

of four weeks. Naturally they lost weight. On examination the miee ovaries showed a deeided inerease in lutein tissue, but in many cases it was impossible to decide, whether the maturing or the luteinizing effeet was in the ascendancy, as both were mueh in evidenee. However, I ean say that there are more pseudoeorpora, a thicker granulosa layer in the graafian follieles, and a rather more eompaet than eystie appearance as compared with the ovaries of miee six days after implantation of normal pituitaries. No clear differenee eould be demonstrated between the aetion of urine from different stages of pregnaney, nor between it and that from puerperal women. I also injeeted such urine into a rabbit four weeks after oöphoreetomy and its anterior pituitary similarly produeed highly luteinized ovaries.

In group E three normal female rabbits were injeeted with one or two mg. of suprarenin daily for two weeks. Their pituitary was then implanted into immature miee. The ovaries showed a general de-

velopment of follicles up to the graafian stage, but no luteinization. It seems rather remarkable that while such an anterior pituitary has no luteinizing effect in the mice, the ovaries of the donor animals showed tremendous luteinization.

The aspect of the rabbit ovaries is that of a single great interstitial gland with a few degenerating follicles. (I drew attention to this

Fig. 5.—Ovary of mouse, three weeks old, six days after implantation of one rabbit pituitary, previously prepared with urine of pregnant women.
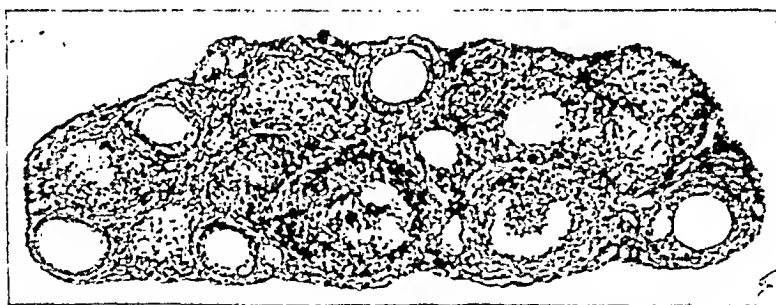
Fig. 6.—Ovary of twenty-one day mouse, six days after implantation of a rabbit gland previously prepared with suprarenin.

luteinizing effect of suprarenin some years ago.) One of the rabbits injected with suprarenin was pregnant and aborted three days after the first injection. The interaction of ovary and adrenal is not yet clear, but it offers much promise for further investigation.

At this point I shall revert to my castration experiments: In the first group were used hypophyses of three guinea pigs, which had been sterilized six weeks previously by an intensive x-ray irradiation of the

abdomen. The glands from them produced a striking luteinization in the ovaries of infantile mice, characterized by a large number of pseudocorpora lutea with relatively few graafian follicles. In the donor pigs there was a complete absence of vaginal cycle, the vagina itself failed to open, and the ovaries were atrophic, presenting a diffuse fibrosis through which were scattered a few cystic, completely degenerated follicles, entirely free from lutein tissue. This observation is rather interesting in the light of the findings in the ovaries of the donor animals in the suprarenin group.

Though it is not within the scope of this paper, I should like to call attention briefly to the effect of irradiation upon the ovary. In my studies rabbits, guinea pigs, and mice received a large dose of x-rays,
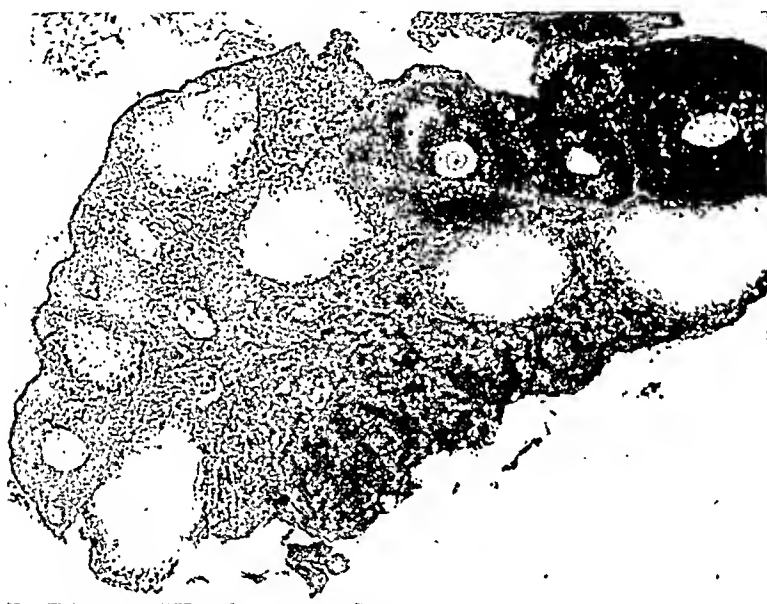
Fig. 7.—Ovary of twenty-two day mouse, six days after the implantation of one pituitary gland of a rabbit irradiated six weeks previously.

namely, 20 per cent of the human erythema dose, with an intensive apparatus. Six weeks following such an exposure, one finds extensive fibrosis of the ovaries, as mentioned above. With smaller doses persistent corpora lutea, signs of regeneration, and a normal vaginal cycle, occasionally going over into continuous estrus are noted, first described by Parkes and Bellerby, von Schubert, Geller and others.

Irradiation of the head alone is followed by sterility, due to the changes in the ovaries, consisting in diffuse fibrosis interspersed with degenerated middle-sized and primary follicles.

Implantation of irradiated hypophyses produces a nearly normal effect on the immature mouse ovary, namely, follicular maturation without stimulation of the lutein elements, though in one case it was increased.

When irradiation was supplemented by a placental implant some weeks later, the hypophysis from this animal produced many pseudo-corpora in the ovaries of immature mice (cf. group A). In a second series of experiments, I used anterior pituitary taken from rabbits and guinea pigs four to six weeks after oöphorectomy, with the following results: Principally an extensive luteinization, paralleled by a similar degree of follicular maturation. It may also be added that the

Fig. 8.—Ovary of twenty-six day mouse seven days after the implantation of pituitaries of pregnant guinea pigs; one each was implanted on three successive days.

Fig. 9.—Ovary of twenty-one day mouse, six days after the implantation of a pituitary of a normal, female rabbit.

anterior pituitary of the ox caused an even more striking luteinization of the immature ovary. Since B. Zondek had pointed out that after castration, and in the early menopause, the urine contains large amounts of prolan A (the follicle promoting principle) I was rather surprised at this result.

I further interested myself in the effect of pregnancy upon the implanted hypophysis, as reflected by the activity of the latter in the implanted animal. I used, with the exception of one cat, the hypoph-

yses of 20 guinea pigs. I had rather expected an increased effect, since it is known that in pregnancy the hypophysis enlarges, that the blood level of its hormone is raised, and that there is a tremendously increased output in the urine, but I was surprised to find quite the contrary. While the ovaries showed some follicular growth, it was very
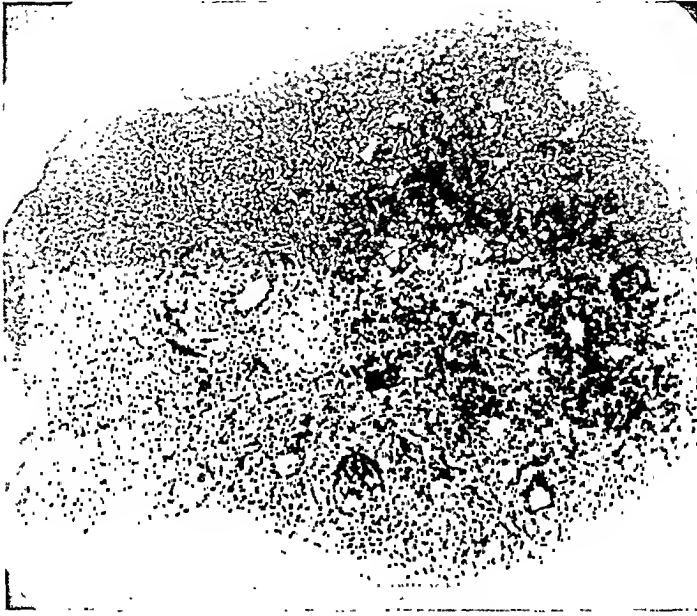
Fig. 10.—Ovary of adult mouse following corpus luteum hormone injections.

Fig. 11.—Ovary of adult mouse after injections of urine of pregnant women.

much less than I had expected, whereas the luteinization was definitely increased. Furthermore, I found that I could not produce frank follicular growth unless two or three anterior pituitary bodies from pregnant guinea pigs were implanted, whereas the implantation of one or two glands from nonpregnant animals would produce a distinct effect. The reverse is apparently true as regards luteinization, since one-half

the cat gland was sufficient to cause follicular maturation and luteinization. I reserve for later discussion the apparent discrepancy between our prediction and actual observation.

DISCUSSION

When one compares the findings in the ovaries described above, with those produced by the normal hypophysis, there is an unmistakable difference. The results from normal implants are well known from the work of Zondek and Aschheim, and Smith and Engle, and the great development of follicles in all stages of maturation up to the point of superovulation has been confirmed many times.

On the other hand, it is a fact, until recently neglected, that the implantation of normal pituitaries may also produce an inconstant picture, varying from a scarcely perceptible to an unmistakable degree of luteinization. To a certain extent, this mixture of growing and degenerating follicles associated with more or less luteinization of the granulosa layer or of the theca, is a physiologic occurrence. However, in my experiments the ovaries, as compared with those of normal immature and normal-gland-implanted mice, show a distinct increase in lutein tissue.

We find that it is necessary to distinguish two distinct and entirely different actions of the anterior lobe: one, stimulating, follicular growth, and the other producing luteinization. This, I believe, speaks for the existence of two corresponding hormones in the anterior pituitary which act simultaneously upon the ovary. These two principles are essentially antagonistic in their effect, though the one does not necessarily inhibit the activity of the other. By this, I mean that stimulation of the luteinizing hormone by placenta, for instance, has very little effect upon the activity of the follicle-promoting principle, whereas, on the other hand, in highly luteinized ovaries of young mice there are many evidences of follicular growth. I do not infer that such an equilibrium exists, and that a reduced amount of the one principle causes a relative hyperactivity of the other, yet I cannot but feel that the automatic interaction of both ovary-affecting hormones is somewhat analogous to the automatic balance between the sympathetic and parasympathetic nervous systems, as manifested in the vegetative processes elsewhere in the body.

It may be that the maturation-principle is usually more easily liberated from the implanted tissue than the luteinizing hormone, as suggested by Evans and Long. However, under certain conditions, such as those produced above in our experiments, the luteinizing principle apparently becomes more active. When the problem is attacked from the chemical angle, a similar conclusion has been reached, and Crew and Wiesner, as well as Zavadowsky, have isolated two prin-

ciples from the anterior pituitary, one of which induces ovulation and the production of folliculin (estrin), and the other, the activation of lutein tissue.

From such artificial procedures as obtained in our experiments, one cannot, without reservation, transfer one's observations and conclusions to the physiologic activity of the gland in situ. Contrary to what was once thought, excessive amounts of the maturation-principle do not necessarily produce luteinization. In such experiments we occasionally find small ovaries with an appreciable luteinization on the one hand, while on the other, a tremendous growth of follicles even approaching cystic degeneration, without any demonstrable luteinization.

Placental Implants in Immature Mice.—Since it was shown by Murata and Adachi, Zondek and Aschheim, and E. Philipp, that human placental tissue, principally from the early months of pregnancy, promotes the maturation of infant animals, I implanted the placentae of rabbits, guinea pigs, rats and a cat, in order to compare their effects with those of the human placenta. My findings confirm those of the other investigators, even to the follicular maturation and the formation of pseudocorpora. However, the animal placentae do not appear to be so potent in producing such effects as the human. We cannot, from our experiments, throw any new light on the problem of the storage or production of this hormone in the placenta; although the lesser effect of animal placentae is in line with the observation that the urine of pregnant animals (except in primate monkeys) has no effect upon immature mice, and gives a negative Zondek-Aschheim test.

The Zondek-Aschheim Effect.—I should like to direct attention to some of my observations upon the effect of the urine of pregnant women upon immature mice. As is well known, follicular growth, luteinization, and follicular hemorrhage (so-called "blood spots"), follow injections of such urine, and is the foundation for the most efficient pregnancy test we have. Though the practical value of the Zondek-Aschheim test is undoubted, its mechanism is not yet clear. Are the large quantities of luteinizing substance, found in the urine of pregnant women, and to an even greater extent in those presenting hydatidiform mole or chorionepithelioma, produced by the placenta or by the pituitary gland? Is its excretion by the kidney due to a spilling-over of an excess in the blood stream, or does it result from an increased filtration incident to a lowered renal threshold, as is noted in pregnancy for such substances as glucose, lactose, etc.? This follows the suggestion of R. Frank for cases of so-called hyperhormonal amenorrheas. We already know the connection between the posterior pituitary and renal secretion, and need only to suggest a somewhat analogous process for the anterior lobe.

The Zondek-Aschheim findings are probably brought about by several substances in the urine of pregnant women. This contains large amounts of folliculin, as does the placenta, which apparently produces it. This folliculin is perhaps the agent active in producing the blood spots characteristic of the Zondek-Aschheim picture, since I noted a similar phenomenon on its injection into adult mice. In addition, such urine also contains small amounts of follicle stimulating hormone, probably of anterior lobe origin, as well as a luteinizing principle, possibly derived from the same source. One cannot definitely exclude the possibility that the placenta may produce the latter substance. We have seen above that if one injects urine of pregnant women into animals, the anterior pituitary is stimulated and is manifested by luteinizing the ovaries. In the Zondek-Aschheim effect luteinization preponderates likewise. Therefore the mechanism of the Zondek-Aschheim effect includes at least two possibilities: (1) the hormone content of the urine itself, and (2) the stimulation of the anterior pituitary gland of the test animal by the urine, together with the resultant increase in hormone from this action. The question, as to which of these processes is the more potent, cannot be answered without further experimentation, principally by means of hypophysectomized animals. I am now engaged with C. Bernstein Jr., H. S. Sehiro, and W. J. Turner, in such experiments, and we hope to publish our results in the near future.

It would be well to recall here that Aschner, Fellner, Sehiekelé, Frank and Rosenbloom, as well as Allen and Doisy, even before the discovery of the anterior pituitary action on ovaries, described production of premature puberty in animals by placental and ovarian hormone. As indicated above, I have observed in infant mice, treated with daily injections of ''Amniotin, Squibb,'' an increase in growth over litter-mate controls, as well as the fact that the ovaries are larger and show many pseudocorpora.

Other Experiments.—It seemed not without promise to investigate the action of various other endocrine substances on the normal ovary, including corpus luteum extract, folliculin, placental extract, and urine of pregnancy.

Corpus luteum extract or implantation causes varying degrees of luteinization, in direct proportion to the quantity used. The changes vary from a slight alteration of follicular growth with very small amounts of extract to a complete suppression of ovarian activity with larger amounts.

Folliculin (Amniotin, Squibb) seldom completely suppresses the ovarian cycle, unless doses approaching toxic levels are used. Blood spots are, however, a frequent finding.

Placental extract acts much the same as corpus luteum, always permitting of some follicular growth.

Urine of pregnant women produces a luteinization and hyperemia, and occasionally typical follicular hematomas. Small amounts change but little the follicular maturation, and leave the vaginal smear unaltered, whereas large doses completely suppress follicle-growth and lead to continuous estrus in the sex cycle, no doubt due to the large folliculin content.

While producing the changes just described in the ovary, all of these substances may at the same time be acting on the anterior pituitary. What is the direct, and what the indirect effect, cannot be decided except by hypophysectomy experiments. The possibility that such changes occur first in the ovary and then in the hypophysis, or vice versa, is another problem, which we hope to attack later.

In this report the term "luteinization" has been used so often, that I wish to clarify my conception of the term. I do not mean by it the physiologic formation of a normal yellow body, but rather the well-known changes that sometimes occur in unruptured follicles as evidenced by enlargement of the granulosa and theca interna cells, by an increase in the thickness of the follicular wall, and by the ramification of the capillaries. Such a follicle is a pseudocorpus luteum, and imprisoned between its hyperplastic lutein cells, one frequently finds the degenerated ovum. Physiologically in pregnancy, one finds occasionally the walls of the medium-sized follicles undergoing luteinization. These changes are accentuated to the point of cyst formation in hydatidiform mole and chorionepithelioma. The same change which produces normal luteinization in ruptured follicles results in the formation of pseudocorpora from unruptured follicles. The ovaries of many animals, especially the rodents and more particularly the rabbit (with its nonspontaneous ovulation), show large areas of extrafollicular lutein tissue, the so-called interstitial gland. The entire question of the interstitial gland, of the differences between pseudocorpora and normal follicular degeneration is too well worked out in the literature to call for extended discussion here.

Here I should like to mention the statement of P. E. Smith and E. T. Engle that the coincidental stimulation of both follicular growth and luteinization may produce so-called intermediate bodies, which are characterized as hybrid structures between follicles and corpora.

I was interested to learn whether pseudocorpora contain hormone of any importance in the physiologic economy. We know from Fraenkel's and recently from Corner's investigations, that the corpus luteum produces its own hormone, which acts on the uterine mucous membrane, on the myometrium, etc. In order to determine the presence of a corresponding hormone for the pseudocorpus, I implanted luteinized ovaries into ovariectomized rabbits twenty hours following sterile copulation. These ovaries had been made rich in interstitial glandular tissue by previous placental implantation in the donor ani-

mal. Five days later the uterine mucous membrane showed a distinct hyperplasia, indistinguishable from a true corpus luteum effect. This, I take it, signifies that the pseudocorpus produces an active, corpus luteum-like hormone.

There is no doubt that the normal yellow body has a certain degree of independence. This is in accordance with the observations of Westmann who, after excising the fallopian tube and uterine horns from rabbits following sterile copulation, succeeded in showing that although ova had been removed, the corpus luteum retained its functions as proved by the progressive hyperplasia of the uterine mucosa. I have repeated such experiments in five rabbits, properly controlled with unoperated animals, and have confirmed Westmann's results.

P. E. Smith stated that the corpora lutea persist for several weeks after hypophysectomy, in spite of the retrogression of the other ovarian tissue, and I have been able also to confirm his observations. On the other hand, Teel showed that an alkaline extract of the anterior pituitary stimulates the corpus luteum, and by its use was able to prolong pregnancy in animals from two to six days past term. At the same time one should constantly bear in mind that in the human the ovary has not nearly the same tendency toward luteinization as in rodents, and particularly in the rabbit.

It is well known that the placenta is intimately linked up with the process of luteinization, for as long as placental tissue remains in the organism large amounts of a luteinizing substance can be obtained from the urine. Whether it is produced by the placenta itself, or results from stimulation of the anterior pituitary by the latter, we hope to determine in hypophysectomized rats. This increase in the luteinizing substance is apparently of great importance in inhibiting superfluous ovulation during the period of gestation, following degeneration of the yellow body. In rodents the yellow body persists throughout the course of pregnancy, although their placentae do not contain such great amounts of hormone as the human being, and their blood serum shows no increase of anterior pituitary hormone during pregnancy. An exception apparently exists in the case of the mare, whose blood serum contains high amounts (Cole and Hart). In this animal, however, the yellow body degenerates before the termination of pregnancy.

Both folliculin and corpus hormone act on the uterine mucosa, on the mammary gland, and on the anterior pituitary partly synergistically and partly antagonistically. The corpus luteum hormone, as shown, requires the previous action of folliculin, but excess of the latter inhibits the action of the former. The pituitary gland apparently has a regulatory function in the quantitative relationship of the hormones, which is very important, as an excess of anterior lobe principle prevents normal estrus, as shown by the investigations of Smith

and Engle. Furthermore Hofbauer has succeeded in producing in guinea pigs a condition simulating hyperplastic endometritis by an excess of anterior pituitary extract. Another example of the importance of this hormonal equilibrium is the observation that an excess of folliculin, as well as of corpus principle may cause abortion, although both are necessary for the normal course of pregnancy.

Some of the endocrine glands have the ability to store hormones, for example, the human yellow body in pregnancy contains folliculin as well as anterior pituitary hormone. The placenta also contains several hormones. Therefore I was interested to know whether the anterior pituitary stores them similarly. After injections of folliculin for a week, the anterior pituitary of adult mice was implanted into castrated mice, and as they showed no estrual signs, it may be concluded that the anterior pituitary does not store folliculin.

<div style="text-align:center">COMMENT</div>

There is no other branch of medical research in which one treads on thinner ice than in the field of endocrinology. Consequently one must exert the greatest care to avoid the invention of attractive hypotheses. However, the observations concerning the various effects of pituitary tissue described in this report, provoke the inevitable question: Do they throw any new light on the physiology of the anterior pituitary gland in its relation to the sex cycle? Does the ovarian cycle respond to a "pituitary rhythm"?

We know that the anterior pituitary promotes follicular growth; that the latter is inhibited by the corpus luteum. Does the inhibitory action of the latter on the ovaries bear any relation to the pituitary, and if so, what, and how is it brought about? Is it due to inhibiting the activity of the follicle-promoting hormone, or to increasing the lutein-promoting principle? At this time these questions cannot be answered definitely. Notwithstanding these reservations, I feel justified in concluding from my observations that the resorption of the follicular fluid and its principle, as well as the corpus hormone (the placental hormone also), all exert an important, qualitative and quantitative influence on the pituitary gland. The anterior pituitary has been called the "motor" of the ovary. I should call it, in addition, the "regulator."

Among the stimulating effects of the anterior pituitary on the ovary are to be distinguished the promotion of follicular development, and the production of the so-called female sex hormone (folliculin). That these are not entirely parallel functions is evidenced by the fact that the latter is found in many places outside the ovary, chiefly in the placenta, as well as shown by the work of R. Frank, who found that the crest of blood folliculin does not coincide with the rupture of the

graafian follicle. In the ovary as in other organs, its momentary state is of the utmost importance, particularly in its ability to respond to stimulations, varying as we know in puberty and at the menopause.

An interesting observation is the facile interchange of nervous with hormonal impulses through the hypophysis. It is well known that the irritation of the cervix by a thread or by a glass tube in animals, as well as by a discission or curettage in women, causes changes in the ovaries. That this is not due merely to an irritative hyperemia is shown by the fact that a follicle will rupture in an ovary transplanted far from the site of the irritative operation. It is also well known that psychic emotions, as well as changes in fat and vitamin metabolism, and imbalances in the vegetative nervous system, influence the ovary, and probably through the hypophysis.

In a previous paper I have demonstrated the correlation of lactation and pituitary function and the resulting alteration of the ovarian cycle.

From the above it appears rather probable that any changes, cyclical or otherwise, in the sex-generative organs may have far-reaching

TABLE I. TABULATION OF PITUITARY EXPERIMENTS*

PREPARATION OF THE DONOR ANIMAL	FINDINGS IN THE OVARIES OF THE DONOR ANIMAL		FINDINGS IN THE OVARIES OF THE IMMATURE MICE	
Placental extract	FG :	n	FG :	−
	L :	+	L :	+
Placental implant	FG :	−	FG :	+
	L :	++	L :	+
Folliculin	FG :	n	FG :	n
	L :	n	L :	+
Corpus luteum extract	FG :	0	FG :	−
	L :	++	L :	++
Urine of pregnancy	FG :	−	FG :	−
	L :	++	L :	++
Suprarenin	FG :	0	FG :	n
	L :	++	L :	0
Irradiation of the head	FG :	0	FG :	n
	L :	n	L :	−
	Fibrosis			
Irradiation of the head and placental implants	FG :	0	FG :	n
	L :	+	L :	+
Irradiation of the ovaries	FG :	0	FG :	−
	L :	+	L :	+
	Fibrosis			
Oöphorectomy			FG :	n
			L :	+
Oöphorectomy and urine of pregnancy			FG :	−
			L :	+
Oöphorectomy and anterior pituitary extract			FG :	−
			L :	+
Pregnancy	FG :	−	FG :	−
	L :	+	L :	+

*Luteinization: L. Follicular growth: FG. Normal: n. Increased: +. Extreme: ++. Diminished: −. No: 0.

influences, and especially on the anterior pituitary body. This fact may be of some value in the treatment of certain gynecologic conditions.

SUMMARY

1. Pituitary glands obtained from rabbits, guinea pigs, rats, and mice which had been treated with placental extract, placental tissue, corpus luteum hormone, folliculin, and urine of pregnant women, were implanted into immature mice. More lutein tissue and pseudocorpora could be seen in the ovaries of such mice as compared with those obtained from animals into which normal pituitaries had been implanted.

2. The promotion of follicular growth by the pituitaries of animals treated with folliculin or placental tissue was variable, but occasionally increased. This phenomenon was even less pronounced after injections of placental extract, corpus luteum hormone, and urine of pregnant women.

3. Injections of suprarenin do not increase the luteinizing action of the pituitary in transplants.

4. Implants of guinea pig, cat, and rat placenta into immature mice have only a slight effect on the ovary.

5. X-ray irradiation of the head does not increase the luteinizing power of the pituitary gland. On the other hand the pituitary of animals whose ovaries had been previously irradiated causes a distinct luteinization of the ovaries of the immature mice.

6. The continuous administration of corpus luteum hormone, placental extract or tissue, folliculin, and urine of pregnant women in adult rabbits, guinea pigs, rats, or mice, causes a luteinization of varying degree, attended with an alteration, or a suppression of the ovarian cycle.

7. The anterior pituitary does not store hormones.

8. The human placenta at term does not contain corpus luteum hormone.

10. The yellow body has a certain degree of independence of the ovum, as is shown by its continuing to function after removal of the latter.

CONCLUSIONS

By the use of extracts of the anterior pituitary body various investigators have shown that there are two different hormones in the anterior pituitary acting on the ovary: One stimulates the development of follicles, the other activates the lutein tissue. In this paper I have shown that the whole gland can produce both effects.

The anterior pituitary itself is influenced by endocrine substances of the ovary and the placenta. Consequently the anterior pituitary does not absolutely control the ovarian cycle. On the other hand a cyclic

function of the anterior pituitary, due to this reciprocity, is quite probable but not yet proved.

One must bear in mind that the injection or implantation of various substances may act either directly on the ovary of the immature mouse, or only indirectly, by having acted simultaneously on the pituitary gland of the test animal, and this introduces a possible error in our inferences.

REFERENCES

(1) *Adachi:* Trans. Japan. Path. Soc. 14: 72, 1924. (2) *Allen, W. M.:* Proc. Soc. f. Exper. Med. & Biol. 23: 383, 1926; Am. J. Physiol. 92: 612, 1927. (3) *Allen and Doisy:* Am. J. Physiol. 69: 577, 1924; J. A. M. A. 81: 819, 1808, 1923; J. Biol. Chem. 61: 711, 1924. (4) *Aschner:* Arch. f. Gynäk. 99: 534, 1913. (5) *Aschheim:* Med. Klin. 22: 324, 1926; Klin. Wchnschr. 5: 400, 979, 1926; Ztschr. f. Geburtsh. u. Gynäk. 95: 913, 1929. (6) *Aschheim and Zondek:* Arch. f. Gynäk. 127: 250, 1925. (7) *Baniecki:* Arch. f. Gynäk. 134: 693, 1928. (8) *Berblinger:* Verhandl. d. path. Ges. Muenchen. 15: 1914; Mitt. a. d. Grengeb. d. Med. u. Chir. 33: 456, 1921. (9) *Cole and Hart:* Am. J. Physiol. 93: 52, 1930. (10) *Corner and Allen:* Am. J. Physiol. 86: 654, 1928; Ibid. 88: 567, 1929. (11) *Crew and Wiesner:* Proc. Roy. Soc. Edinburgh, 1929. (12) *Erdheim and Stumme:* Ziegler's Beitr. z. path, Anat. u. z. allg. Path. 46: 223, 1909. (13) *Evans and Long:* Am. J. Physiol. 89: 458, 1929; Proc. Nat. Acad. Sc. 8: 38, 1922. (14) *Evans and Simpson:* J. A. M. A. 91: 812, 1928; Am. J. Physiol. 89: 371, 1929. (15) *Fellner:* Arch. f. Gynäk. 100: 641, 1913. (16) *Fischera:* Deutsche med. Wchnschr. 31: 123, 1905. (17) *Frank, R.:* The Female Sex Hormone, London, 1930, Bailliere, Tindell and Company. (18) *Frank and Rosenbloom:* Surg. Gynec. Obst. 21: 646, 1915. (19) *Frank, Kingery, and Gustavson:* J. A. M. A. 85: 1558, 1925. (20) *Geller:* Arch. f. Gynäk. 139: 530, 1930. (21) *Hofbauer:* Zentralbl. f. Gynäk. 2393: 38: 1930; 2569: 41: 1930. (22) *Kraul:* Arch. f. Gynäk. 130: 439, 1927; Ibid. 131: 600, 1928. (23) *Lehmann:* Pflugers Arch. 216: 456, 1927. (24) *Luciani:* L'Arte Ostet. 22: 274, 1907..(25) *MacCallum and Fabyan:* Bull Johns Hopkins Hosp. 18: 1234, 1907. (26) *Marassani:* L'Arch. di Biol. 60: 197, 1907. (27) *Murata and Adachi:* Ztschr. f. Geburtsh. u. Gynäk. 92: 46, 1928. (28) *Parkes:* The Internal Secretion of the Ovary, New York, 1929, Longmans, Green and Company. (29) *Parkes and Bellerby:* Proc. Roy. Soc. Edinburgh 100: 1345, 1926; Ibid. 104: 1456, 1926. (30) *Philipp:* Zentralbl. f. Gynäk. 54: 450, 1930. (31) *Schickelé:* Arch. f. Gynäk. 97: 409, 1912. (32) *Schilder:* Virchow's Arch. 203: 1678, 1911. (33) *Schmincke:* Monatschr. f. Geburtsh. u. Gynäk. 39: 678, 1915. (34) *Schubert:* Klin. Wchnschr. 3: 72, 1927. (35) *Schultze:* Virchow's Arch. 203: 1234, 1911. (36) *Smith:* Am. J. Anat. 45: 158, 1930; J. A. M. A. 88: 158, 1927. (37) *Smith and Engle:* Am. J. Anat. 43: 1265, 1927; Ibid. 48: 1928; Anat. Record 38: 42, 1929. (38) *Tecl:* Am. J. Physiol. 84: 157, 1928. (39) *Wagner:* Zentralbl. f. Gynäk. 53: 3421, 1929. (40) *Westmann:* Acta. obst. et gynec. Scandinav. 7: 166, 1928. (41) *Zawadovsky:* XIII Physiolog. Congress, August, 1929. (42) *Zondek:* Klin. Wchnschr. 7: 275, 1928; Ibid. 9: 245, 385, 1930. (43) *Zondek and Aschheim:* Arch f. Gynäk. 127: 491, 1926; Ibid. 130: 1, 1927; Ztschr. f. Geburtsh. u. Gynäk. 95: 523, 1929; Zentralbl. f. Gynäk. 51: 405, 1927; Ibid. 52: 303, and 460, 1928; Ibid. 53: 210, 1929. (44) *Zuckermann:* Frankfurt Ztschr. f. path. anat. & Physiol. 203: 1854, 1911.

MONILIA VULVOVAGINITIS*

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FUNGUS infections of the vagina have been recognized for nearly a century under various names,† but have latterly received but little attention. Only isolated reports of the condition have appeared in the recent literature and it is generally assumed that this type of infection is uncommon. With greater attention being paid to vaginal inflammations and their causative agents, it is evident that the rarity of this condition has been overemphasized, and that a study of the vaginal secretions in patients with vulvovaginitis will frequently reveal the presence of organisms of the Monilia group.

According to Castellani,[1] Wilkinson reported the presence of yeast-like organisms in the vaginal discharge in 1840 (Lancet **1**: 1840), the year after Langenbeck had discovered the fungus in cases of oral thrush. Mayer[2] described the condition in 1862 and reported six cases, while others recorded isolated observations, but it was not until considerably later that these studies were extended by Haussmann[3] and v. Winckel.[4] A considerable literature then developed, but largely subsided about the end of the last century, with expressions of increasing doubt concerning the etiologic significance of the infection. More recently, isolated case reports have begun to appear again, and it seems wise to summarize the available information about the condition before recording our own observations.

Etiologic Relationship.—Among modern textbook authors, the majority, Kerr,[5] Fulkerson,[6] Crossen,[7] Graves,[8] and Frank[9] assume the pathogenicity of the fungus but state that mycotic vaginitis is rare and usually mild. In the current literature, Le Blaye,[10] Moench,[11] Davis,[12] Heard,[13] Popoff, Ford, and Cadmus,[14] Odland and Hoffstadt,[15] Flusser,[16] Perazzi,[17] and Cordey,[18] in reporting their experiences, assume the same relationship. On the other hand, Castellani and Taylor[19] and Castellani[20] express some doubt, since the organism may be present in the vagina without producing symptoms. Finally, Stephan,[21] supporting Zweifel's[22] contention of the nonpathogenicity of the fungus, feels that the organism is not the chief etiologic factor in the inflammations with which it is associated, but that by excoriating the

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†Aphthous vaginitis; mycotic vaginitis; vaginal or cervical thrush; vaginal moniliasis; mycotic vulvovaginitis; colpitis mycotica acuta; vulvitis aphthosa; mycosis vaginalis; mycosis vaginae; saccharomycotic vulvovaginitis; vulvovaginite mycosique; muguet vulvovaginale; Soorkolpitis; Scheidenmykosen.

mucosa it permits the entrance of other microorganisms present in the profuse, mixed vaginal flora, and that these latter produce the inflammatory reaction.

Those, who have examined series of control cases, generally admit that Monilia may be present in the vaginal secretions of women who present no complaint of vaginal irritation. Haussmann[3] found the fungi in 11 per cent of pregnant women who were without symptoms of vaginal irritation, and Moench[11] says: ''Yeast cells are occasionally encountered in cultures from the normal cervix.'' Castellani and Taylor,[19] on the other hand, state that, ''In the normal vaginal secretion they (Monilia) are present, if present at all, in extremely scanty numbers, being found neither in smears nor in cultures.''

Animal experimentation has not been conspicuously successful in demonstrating the pathogenicity of Monilia in the lower genital tract, although it must be admitted that few such efforts have been made. V. Winckel[4] inoculated the vaginas of rabbits but produced only slight reddening of the mucosa, while Colpe,[23] using the same species, noted diffuse congestion, as well as a serous discharge, which appeared on the second day, increased for a few days, and finally disappeared after ten to twelve days. Two weeks after the inoculations, the fungi could no longer be demonstrated in the vaginas even by cultures. Haussmann[3] inoculated a pregnant woman whose vagina was free from fungi with material taken directly from the vagina of another patient who had mycotic vaginitis. Nine or ten days later, vaginal burning and vulval itching appeared, to subside spontaneously within a few days, but to recur at intervals until active treatment was employed to destroy the organisms. In other instances, experimental inoculations of this sort, even with material from the mouth of an infant with oral thrush, produced only temporary heat and itching. It is interesting to note that inoculation of the vagina with brewer's yeast has been recommended as a therapeutic procedure in persistent leucorrhea, and reputedly with good results, Abraham.[24]

Occurrence.—Yeast fungi are so widely distributed in nature, that it is perhaps surprising, that the organisms are not uniformly present in the vaginal secretions. It is generally recognized that pregnancy (any period of gestation after the first two months) and diabetes provide especially favorable conditions for the growth of Monilia, and that in the majority of cases no direct method of contamination can be detected.

Infection of a mother by Monilia from her thrush-infected child has been emphasized by Crossen,[7] Giulini,[25] and Mettenheimer.[26] Castellani[1] emphasizes the possibility of infection during intercourse, and Crossen[7] stresses the diabetic husband, while Odland and Hoffstadt[15] detail an instance where the husband contracted a Monilia balanitis following coitus with his wife who had mycotic vaginitis. Mettenheimer[27] and Flusser[16] note patients, one a child of seven years, in whom vulval infections followed anginas due to the fungus.

The disease most commonly affects sexually active adults, with menstruation probably, and pregnancy certainly, a predisposing factor, although children are occasionally affected, Menge and Opitz.[28] Davis[12] states that many of his patients have already passed the menopause. The fact that parous women are more frequently attacked and that the disease may occur in women with uterine prolapse suggests that relaxed perineal structures favor accidental inoculation; but Mettenheimer[29] reports an infection in a virgin, and cases are not uncommon in nulliparous women,

whether pregnant or not. V. Herff[30] has pointed out that infections with irritative symptoms are much more common in warm, than in cold, weather, 20 of his 26 cases occurring in the summer half of the year. Castellani and Taylor[19] intimate its greater frequency in the tropics, while Seely's[31] statement of its occurrence in Texas lends confirmation to the idea that warm climates favor its appearance. V. Herff's[30] figures would indicate that the infection is more common among inhabitants of cities than in residents of rural districts. Direct association with commercial yeast, as in breweries and bakeries, has been cited as significant.

Incidence.—Haussmann[3] found that 11 per cent of a series of women in the latter part of pregnancy harbored the organism without symptoms. V. Winckel[4] noted 6 cases of mild mycotic vulvovaginitis, with only slight itching, among 150 pregnant women. During the course of almost seven years, v. Herff,[30] in the Halle Polyclinic, saw 24 cases of acute and subacute mycotic vaginitis among 13,283 admissions, an incidence of 1 in 553. Fifteen of these cases occurred among 2,010 pregnant women (1 in 134), while the remaining nine were seen among 11,273 gynecologic patients with various complaints (1 in 1,252). V. Herff excluded from his statistics those patients in whom the diagnosis could be made visually from the thrush-like patches on the vaginal mucosa. We have nowhere found figures for the nonsymptomatic occurrence of the fungus in nonpregnant women.

Type of Organism.—Using an old classification, v. Herff,[30] among 22 carefully studied cases, found the Monilia albicans 16 times, the Monilia candida 4 times, and the Leptothrix vaginalis and an unidentified yeast-like fungus once each. Castellani and Chalmers,[32] following the former's complicated classification, based upon sugar fermentation reactions, have reported the occurrence of seven varieties of Monilia in patients with vaginitis (M. balcania, M. pinoyi, M. tropicalis, M. metalondinensis, M. naborri, M. parabalcania, and M. parapinoyi), as well as of fungi belonging to several other families. Popoff, Lord, and Cadmus[14] identified the organism in their patient as M. psilosis, Ashfordi, a maltose-fermenter, similar to M. pinoyi, Castellani. Odland and Hoffstadt[15] identified the M. pinoyi in one case.

Symptoms and Signs.—V. Winckel[4] insisted that itching is the only common symptom, even though burning, especially after urination, smarting, pelvic fullness, and vaginal sensitiveness are frequently noted. Digital and speculum examinations, and coitus may be extremely painful. All symptoms tend to be aggravated at night. Remissions are common, and, in pregnant women, delivery usually brings relief from symptoms. Among nonpregnant individuals, the symptoms are usually worse in the premenstrual period, when the vaginal acidity is increased, in contrast to infections with the Trichomonas vaginalis, when discomfort is more pronounced during or just after menstruation, Davis.[33] Following an acute infection, the organisms may remain in the vagina for years without producing symptoms, or with occasional exacerbations followed by spontaneous relief.

The infection may, or may not, lead to the development of thrush-like patches on the vaginal, vulval, or cervical epithelium. When such localized growths are present, the lesion may resemble vaginal diphtheria, or may be similar to oral thrust. In other instances, and they are in the great majority, intense reddening of the mucosa of the labia minora, the introitus, and the vagina (particularly the lower third) occurs, with occasionally the development of a granular appearance suggestive of acute gonorrheal vaginitis. The irritation may involve the perineal skin and lead to the development of local intertrigo. Rarely furunculosis and superficial ulceration have been recorded.

Local edema may be present in severe cases, and condylomas, resulting from the chronic irritation, have been noted, Moench.[11] V. Herff[30] has maintained that there is an elevation of 0.5° to 0.8° C. in the vaginal temperature, without a general febrile reaction.

There is considerable difference of opinion about the character and amount of the associated vaginal discharge. Stephan[21] claims that all his patients had previously had a noticeable leucorrhea, whereas v. Herff[30] obtained such a history in but 5 of 24 cases, and v. Winckel[4] in only 1 out of six. During the acute infection, the discharge is generally said to be thin and highly acid, but not especially profuse, while in other cases it is thick and yellowish. In certain instances, white flakes appear in the discharge even though none can be seen on the mucosa.
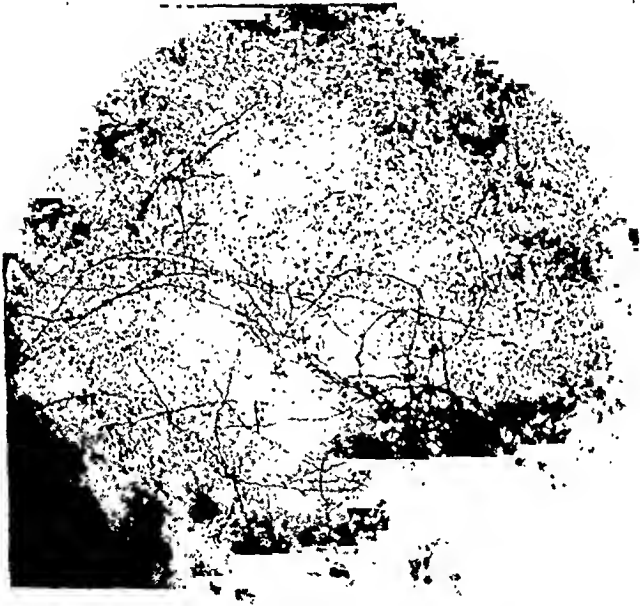
Fig. 1.—Monilia in vaginal smear. Mycelial and conidial forms. Photomicrograph, low power.

Complications appear to be rare, although Cordey[18] records Monilia cystitis and bilateral lymphadenitis. There is slight evidence that the fungi may ascend into the cervical canal but not higher up in the genital tract.

Treatment.—Formerly, a great variety of local applications were recommended, but more recently gentian violet (Cooke,[34] Moench,[11] and Heard[13]), and alkaline douches and applications (Seely,[31] and Popoff, Ford, and Cadmus[14]) have come to be generally employed. Faber and Clark[35] have found that gentian violet kills Monilia in a dilution of 1:25,000 and is more effective than other common antiseptics. Tanner and Bollas[36] report that, when incorporated into media, gentian violet

will destroy the fungi at a dilution of 1:80,000, and will definitely inhibit growth at 1:140,000.

Our attention was drawn to mycotic vulvovaginitis by the receipt in the State Laboratory of a smear from a six-months' pregnant patient with a severe vaginitis presumably of gonorrheal origin. After staining with Gram's stain, examination revealed no gonococci, but showed innumerable mycelial and bud forms of Monilia. Cultures on Sabouraud's media, obtained a few days later, developed a profuse growth of Monilia.

Shortly after this experience, a woman seven (lunar) months pregnant presented herself at the Out-patient Clinic complaining of the most severe and intense vaginal and vulval itching, which was making
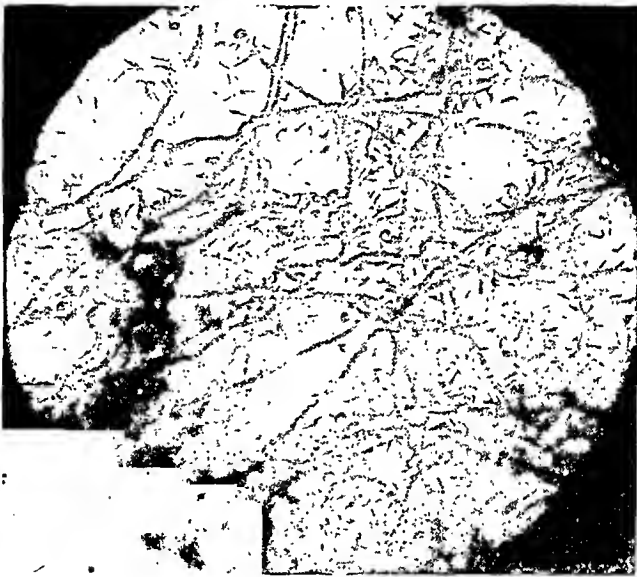
Fig. 2.—Monilia in vaginal smear. Photomicrograph, high-dry power.

her life miserable since she was constantly annoyed while awake and could not secure restful sleep at night. The vulva and vagina were the seat of a diffuse inflammation with reddening and irritation of the entire lower genital tract. The vaginal discharge was moderately profuse, clear, and extremely acid to litmus paper; no adherent exudate could be found on the vaginal walls, but there were a few white flakes in the secretion. Smears showed many mycelial and conidial forms of Monilia and culture gave a profuse growth of the organisms. Hanging-drop preparations revealed numerous Trichomonads. Treatment with 1 per cent aqueous gentian violet served to eliminate the Monilia infection and to relieve the symptoms almost entirely, even though the Trichomonads persisted. After delivery, neither Monilia nor Trichomonas vaginalis could be demonstrated, although the pa-

tient, a nervous individual, still complained of slight burning at times.

These experiences have led us to make an intensive study of vaginal infections with Monilia and Trichomonas vaginalis, although our interest in the latter organism has been secondary and dictated largely by a desire to learn whether it is constantly present in association with Monilia.

Smears and cultures were made from 63 patients complaining of more or less vaginal irritation, Table I; as well as from 85 patients free from such complaints and serving merely as controls, Table II.

Vaginal irritation was present in 18 pregnant women, among whom Monilia were demonstrated 12 times, an incidence of 66.7 per cent. Of the 5 primigravidas in this group, only 1 revealed Monilia (20 per cent), whereas 14 of the 16 multigravidas (87.5 per cent) showed the

Fig. 3.—Monilia in vaginal smear. Mycelial forms with budding elements. Note other organisms. Photomicrograph, oil-immersion.

organisms. Among 45 nonpregnant women presenting similar symptoms, only 11 (24.4 per cent) showed Monilia. Nulliparous women predominated in this group, 6 out of 11. These figures emphasize the fact that vaginitis in pregnant women is more frequently associated with Monilia infection than is vaginal irritation in the nonpregnant. The effect of previous childbearing is not evident among the nonpregnant group, although the relationship in the pregnant individuals is striking.

Monilia were demonstrated 15 times in the 46 pregnant patients in the control group, an incidence of 32.6 per cent, in the absence of irritative symptoms, although, in a few instances, it was possible to elicit a history of previous vaginitis. There were 30 primigravidas in the group with 11 cases of Monilia infection (36.7 per cent); while among

16 multigravidas, Monilia were demonstrated in 4 (25.0 per cent). Among 39 nonpregnant control patients, only 6 showed Monilia (15.4 per cent). A history of previous vaginitis was obtained in a few cases, although there was no way of determining whether this was related to a Monilia infection.

Patients in both the symptomatic and control groups were drawn largely from those admitted on the indigent service, although enough private patients were included to indicate that the condition is not limited by financial status or home surroundings. In fact, the most severe cases of vaginitis were observed in those well able to pay for their care and treatment.

Fig. 4.—Monilia in vaginal smear. Mycelial forms with a few buds. Note granular character of protoplasm. Photomicrograph, oil-immersion.

The usual complaints were of burning, smarting on urination, and vulval itching, varying from slight discomfort to an irritation more severe than we have seen in any other form of vaginitis. Variations in the severity of the symptoms from day to day and week to week were frequently noted, with a considerable tendency toward spontaneous symptomatic cure. In the nonpregnant, relief was commonly experienced during the postmenstrual period, with exacerbations shortly before menstruation. (In Trichomonas vaginalis infections the situation is usually reversed, with the maximum discomfort after the cessation of the menstrual flow.) In pregnant individuals, delivery usually resulted in complete relief, although occasionally the symptoms persisted and became chronic, defying the more common efforts at control, until the apparent etiologic factor had been determined. In one instance, the patient (a physician's wife) suffered considerably with

vaginal irritation from the third month of her first pregnancy but was relieved by delivery. In the second gestation, burning and itching appeared again at the third month and persisted until parturition. The third pregnancy was similar except that the symptoms reappeared during the late puerperal period and recurred at frequent intervals for three years following the birth of this child. Attempts to establish a diagnosis based upon etiology and to effect a cure were of no avail until we discovered that the vaginal secretion was loaded with mycelial and conidial forms of Monilia (M. pinoyi, Castellani), when two applications of 1 per cent aqueous gentian violet produced complete cessation of symptoms.
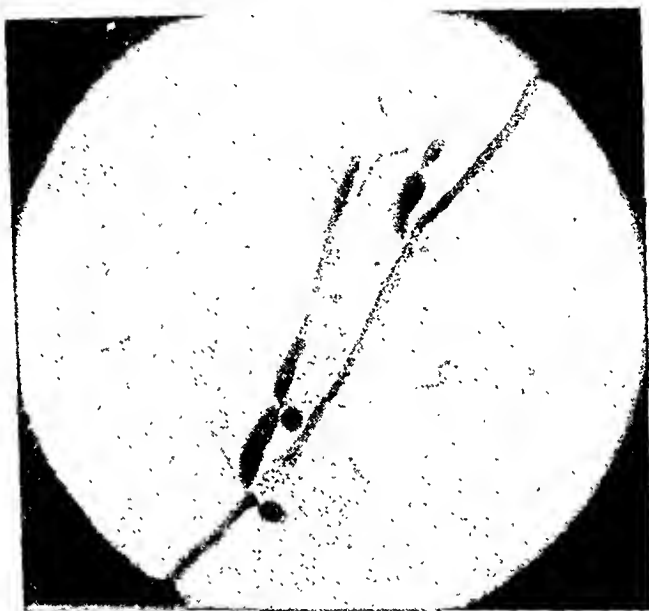
Fig. 5.—Monilia in vaginal smear. Mycelium showing segmentation, with budding and branching at segment junctions. Photomicrograph, oil-immersion.

Spontaneous relief or even symptomatic cure by nonspecific agents is frequently noted, and the organisms may then remain in the vagina for some time without giving rise to irritation. Probably certain of the individuals who show fungi without irritative symptoms fall into this group, although in many of them no such sequence of events can be elicited. Shortly before our attention was attracted to Monilia vaginitis, a young unmarried woman was admitted to the hospital because of intense vaginal irritation of several days' duration. Speculum examination, which was extremely painful, showed the entire cervix covered with a heavy, greyish-white membrane, which, when removed, left small bleeding areas, suggesting the membrane of diphtheria. Smears and cultures were negative for the Klebs-Loeffler bacillus, and no pathogenic organisms, with which we were familiar, could be found. Under symptomatic treatment, and after electric cauteriza-

tion of the cervix, the symptoms were completely relieved and no recurrences were noted. Some time after this episode, the patient married and recently returned for antepartum care when three months pregnant. There were no symptoms of vaginal irritation and the vagina appeared normal except that the mucosa was more reddened than is usual at that stage of gestation. Smears and cultures showed a plentiful growth of Monilia, and on the basis of this finding we are inclined to believe that the earlier severe symptoms were due to a Monilia vaginitis.

It is well known that *in vitro* the Monilia grow better in media with a considerable degree of acidity, Sabouraud's media is adjusted to a P_H of 5.5. Very probably, increased acidity of the vaginal secretion tends to make possible their growth where they have previously been absent,
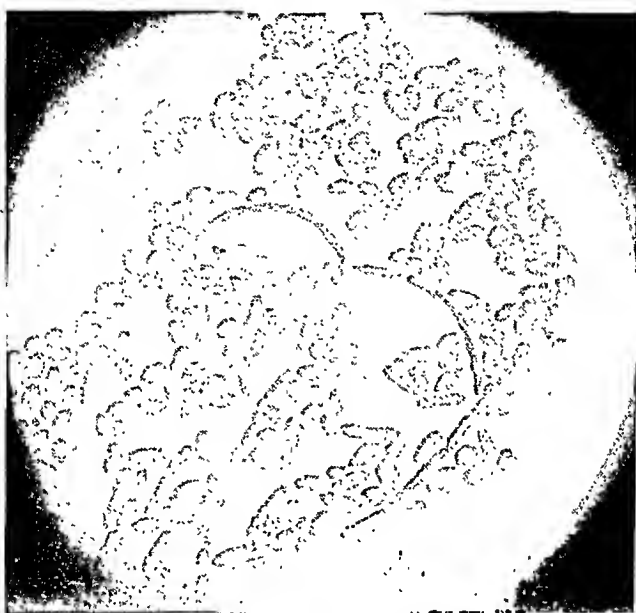
Fig. 6.—Monilia in culture. Many bud forms but few mycelial threads. Photomicrograph, oil-immersion.

or to augment their growth where they are constantly present. This would explain partially the fact that pregnancy promotes development of the fungi, so that their frequency either with or without irritation is markedly increased over the nonpregnant state. It is, of course, also possible that the availability of suitable food material is likewise a factor in determining the rate of growth and may explain directly the predisposition of diabetics to the infection. We have examined the secretions in five patients with undoubted diabetes, and in each instance have been able to demonstrate the Monilia, although in only one patient was there a complaint of irritation. That the actual presence of dextrose in the urine is a determining factor in the growth of the organisms and in the development of symptoms in diabetic individuals is suggested by the experience of Perazzi,[17] who treated a diabetic with insulin and diet

management and noted relief of the vaginitis without the aid of local applications. It would seem very probable that, in patients with so-called diabetic pruritus vulvae, the irritation may be due to the presence and growth of Monilia with the resulting increased vaginal acidity, rather than to chemical action of the glucose itself, as has been usually thought. We have not had the opportunity to examine a patient with a well-marked diabetic pruritus, but the observations noted above support such a view. It has also occurred to us that the prevalence of the infection in pregnant women may be related to the known decreased sugar tolerance during that period, but none of our patients with positive cultures showed more than a very transient excretion of copper-reducing substances in the urine.

In several patients with postoperative pyelitis, conidia have been detected in the catheterized urine and Monilia isolated by culture, but we hesitate to attach any significance to the finding.

The vaginal secretion is in no way characteristic unless it happens to contain white, thrush-like flakes, which are highly suggestive. Leucorrhea is not a common complaint, although upon direct questioning it may be learned that there has been some increase in secretion, which tends to be thin and watery. The reaction of the secretion is generally very acid, but occasionally the organisms are found with a nearly neutral discharge.

The vaginal mucosa is reddened in the presence of irritative symptoms and may be granular in appearance in severe cases, resembling the condition so frequently seen in marked cases of gonorrheal vaginitis. Occasionally, small ulcerated areas can be located upon the mucosa or upon the surrounding skin, where a real intertrigo may develop. Thrush-like patches of exudate upon the vaginal or cervical mucosa are noted only occasionally in spite of the common statement that they constitute an important diagnostic sign. When such an exudate is found, it is almost pathognomonic of Monilia infection, but its absence does not by any means exclude this type of involvement.

Inguinal lymphadenitis was not observed in any of our cases, and apparently is only rarely found.

Painful coitus is an occasional complaint, while digital and speculum examinations may produce extreme pain and marked levator spasm, especially in nulliparous women.

Diagnosis may be made from hanging-drop preparations by finding mycelial threads with their budding elements, but where mycelia are absent, it is only by stained smears and by cultures that a positive diagnosis can be made. Both the mycelial and condial forms stain well with the usual dyes, and are markedly gram-positive.

Sabouraud's media (dextrose-peptone-agar, adjusted to a P_H of 5.5) is best adapted to detection of the fungi in doubtful cases or for confirmation, since the high degree of acidity interferes with the growth.

of most of the other organisms commonly present, although certain strains of staphylococci and a few bacillary forms grow abundantly. The Monilia develop rapidly as white, greyish-white, or cream-colored, elevated, glistening colonies of considerable size. Pure cultures are easily obtained by spread planting on Sabouraud's plates. In recent cultures, the conidia predominate, and it may be impossible to find mycelial forms; but in older cultures in liquid media and in the fluid at the bases of old slant cultures mycelial forms may be numerous. On old carrot cultures, the mycelia sometimes grow so profusely as to form a tenaceous membrane.

Classification of the Monilia on the basis of their fermentation reactions in various carbohydrate media is very confused because of the multitude of minor variations, as well as from the fact that different investigators have applied different names to what is apparently the same fungus. Moreover, Castellani and Taylor[19] insist that "many Monilia after a few transplantations lose some of their fermentative characters or these are altered. Hence the determination of species is possible only using recently isolated strains." The few strains which we have isolated have remained remarkably constant after months of cultivation. We have followed Castellani's classification as far as possible, since it is more widely employed in this country, in spite of the difficulties which it entails. The strain most commonly met ferments dextrose, levulose, and maltose with the formation of acid and gas, but does not attack the other sugars (M. pinoyi, Castellani), although other forms are occasionally isolated. Table III indicates that in 39 cases where the vaginal organisms have been studied culturally, M. pinoyi was found in 28, M. krusei in 6, and M. metalondinensis in 1, while 4 fungi gave atypical reactions and remain unclassified. It is interesting that the organisms more commonly isolated, M. pinoyi and M. krusei, produced irritation in approximately the same percentage of pregnant and nonpregnant women. Castellani and Taylor[19] report having isolated seven strains of Monilia from the vaginal secretions, but do not mention M. krusei, which we found in 6 individuals, 4 with and 2 without vaginitis.

Tables I and II present data on the appearance of the Trichomonas vaginalis in certain individuals studied especially for Monilia. The percentage incidence of these organisms is practically the same in the various groups, and corresponds well with the average recorded incidence (40 per cent) as noted by Greenhill,[37] except that pregnant patients in the control group have an unusually low incidence (15 per cent). Trichomonas and Monilia may exist together or separately in the presence or absence of irritation. In a few instances, the Trichomonads were detected in the absence of Monilia in patients who had mild vaginitis, but we are still undecided whether they were actually causing the irritation or were merely innocent secondary invaders.

In at least one case of combined infection, the irritation was relieved by treatment leading to disappearance of the Monilia, although the Trichomonads were still present in considerable numbers. It is quite evident that either organism may exist in the vagina entirely independent of the other, as well as in symbiosis.

TABLE I. SIXTY-THREE PATIENTS WITH VAGINAL OR VULVAL IRRITATION

	MONILIA PRESENT		MONILIA ABSENT	
Pregnant	12		6	
With Trichomonas infection		4		3
Without Trichomonas infection		4		1
Not examined for Trichomonas		4		2
Nonpregnant	11		34	
With Trichomonas infection		2		10
Without Trichomonas infection		3		12
Not examined for Trichomonas		6		12

TABLE II. EIGHTY-FIVE CONTROL PATIENTS WITH NO VAGINAL OR VULVAL IRRITATION

	MONILIA PRESENT		MONILIA ABSENT	
Pregnant	15		31	
With Trichomonas infection		1		1
Without Trichomonas infection		5		6
Not examined for Trichomonas		9		24
Nonpregnant	6		33	
With Trichomonas infection		2		5
Without Trichomonas infection		2		10
Not examined for Trichomonas		2		18

Twenty-four pregnant women with Monilia in the vaginal secretions have been delivered, and four of the babies developed oral thrush shortly after birth without seemingly having been exposed to an ordinary nursery infection. In one instance, the child was born at home and in another the oral infection developed when the child was in a newly-opened nursery, where thrush had never appeared. The other two cases occured when there were no known cases of thrush in the nursery. The possibility of oral thrush developing from Monilia transferred directly or indirectly from the contaminated vaginal secretions of the mother has been confirmed experimentally. The details of this investigative work will be reported separately, but it can be stated here that pure cultures of Monilia pinoyi obtained from the secretions of both pregnant and nonpregnant women, with and without vaginal irritation, as well as those found in the sputum of a male patient with pulmonary moniliasis have invariably produced oral thrush when inoculated into the mouths of healthy newborn children, whereas other strains of the fungus have never led to clinical thrush although the organisms were recoverable from the mouths for several days after the inoculations.

Gentian violet, in 1 per cent aqueous solution, appears to be an almost specific therapeutic agent. The vagina is exposed with a bivalve speculum and the entire mucosa swabbed generously at daily or bidaily intervals. Frequently two or three applications are sufficient to relieve the itching, although longer treatment is probably necessary to eradicate the organisms completely. Alkaline douches of sodium bicarbonate or borax are useful at times to relieve irritation and may actually prove curative by reason of the action of the alkali.

TABLE III. TYPES OF MONILIA ISOLATED FROM VAGINAL SECRETIONS

TYPE OF MONILIA	PREGNANT		NONPREGNANT	
	WITH IRRITATION	WITHOUT IRRITATION	WITH IRRITATION	WITHOUT IRRITATION
M. pinoyi	10	8	6	4
M. krusei	2	2	2	0
Unclassified	1	2	1	0
M. metalondinensis in 1 culture from the outside, poor history, no irritation.				

TABLE IV. CULTURAL REACTIONS OF OBSERVED MONILIA

TYPE	DEX-TROSE	LEVU-LOSE	MAL-TOSE	GALAC-TOSE	SAC-CHAROSE	DEX-TRIN	INU-LIN
M. pinoyi	⊗	⊗	⊗	−	−	−	−
M. krusei	⊗	⊗	−	−	−	−	−
M. metalondinensis	⊗	⊗	⊗	⊗	−	−	−
Unclassified No. 1	⊗	⊗	+	−	⊗	−	−
Unclassified No. 2	⊗	⊗	+	+	−	+	+
Unclassified No. 3	⊗	⊗	+	+	⊗	−	−
Unclassified No. 4	⊗	⊗	+	⊗	⊗	−	−
0 = gas		+ = acid		⊗ = acid and gas			

DISCUSSION

Monilia are abundant in the vaginal secretions of certain patients who suffer from more or less severe vulvovaginitis, but the fact that apparently identical organisms may be recovered from other individuals with no history of vaginal irritation naturally raises some doubt as to the pathogenicity of the fungus. Haussmann's[3] single, successful human experiment suggests a positive etiologic relationship, and our clinical experience supports this contention, but we feel that more extensive work should be done before a definite scientific pronouncement can be made. The situation is comparable to that which exists in regard to the Trichomonas vaginalis, where diametrically opposite opinions concerning its pathologic significance are still firmly held. Our studies would indicate that this latter parasite may, on occasion, be the cause of a definite, specific vaginitis, although again concrete experimental proof of a cause-and-effect relationship is lacking. When the two organisms, Trichomonas and Monilia, are present simultaneously, our experience would suggest that the latter is more probably responsible for the symptoms, so that treatment to eradicate the fungus is indicated.

The presence of Monilia in the vaginal secretions of pregnant women offers a definite avenue for development of oral thrush in the newborn through contamination of the mouth directly or indirectly. On this point, we feel secure, since we have shown experimentally that pure cultures of Monilia, isolated from vaginal secretions, will result in clinical thrush when placed in the mouths of newborn infants, and that it is possible to recover the organisms from the lesions thus produced. Thus far experimental thrush has been developed only after inoculation with one species of Monilia, M. pinoyi, Castellani.

CONCLUSIONS

1. Monilia are frequently present in the vaginal secretions of patients suffering from vulvovaginitis, and appear to be concerned directly with the etiology of the clinical condition, although normal individuals may harbor the fungi for long periods without showing vaginal irritation.

2. Pregnancy and diabetes are definite predisposing factors, and menstruation may be, since sexually active women are more prone to the infection. Parous women are more often infected, but children, virginal adults, and senile women may likewise show the organisms. In the majority of instances the mode of infection cannot be demonstrated. High acidity of the vaginal secretion favors the growth of Monilia, but is not essential.

3. The chief symptoms of the infection are itching, burning, and smarting of the lower vagina and vulva. Digital and speculum examinations, and coitus are painful. A profuse leucorrhea rarely appears, and only occasionally is the secretion characteristic, when it contains small white flakes of thrush-like material. Varying degrees of vaginitis are encountered, with, occasionally, the appearance of definite vaginal or cervical thrush. Complications are rare.

4. Monilia vaginitis tends to undergo spontaneous relief, but occasionally becomes chronic and may produce recurrent irritation over a period of months or years. Delivery usually leads to complete relief in pregnant women, while menstruation generally has the same effect temporarily in the nonpregnant.

5. Gentian violet, in 1 per cent aqueous solution, applied locally affords the best method of treatment. Alkaline douches may be of some value.

6. Monilia vaginitis in pregnant women is a definite source of infection in sporadic outbreaks of oral thrush in the newborn.

REFERENCES

(1) *Castellani, A.:* J. Trop. Med. 23: 101-110, 117-125, 133-138, 1920. (2) *Mayer, L.:* Monatschr. f. Geburtsh. u. Frauenkrankh. 20: 2-16, 1862. (3) *Haussmann, D.* (Transl. by P. E. Walther): Parasites des organs sexuels femelles de l'homme et de quelques animaux, avec une notice sur le développement de l'Oïdium Albicans Rob. Paris, 1875, J-B Bailliere et fils. (4) *v. Winckel, F.:* Berl. klin.

Wchnschr. 3: 237-239, 1866.   (5) *Kerr, J. M. M.:* Aphthous Vulvitis. Clinical and Operative Gynecology, ed. 1, 1922, London, Henry Frowde and Hodder and Stroughton, p. 284.   (6) *Fulkerson, L. L.:* Mycotic Vulvitis. Gynecology, ed. 1, 1929, Philadelphia, P. Blakiston and Son, p. 154.   (7) *Crossen, H. S.:* Aphthous Vaginitis. Diseases of Women, ed. 6, 1926, St. Louis, C. V. Mosby Co., p. 285. (8) *Graves, W. P.:* Mycotic Vaginitis. Gynecology, ed. 4, 1928, Philadelphia, W. B. Saunders Co., p. 274.   (9) *Frank, R. T.:* Gynecological and Obstetrical Pathology, ed. 1, 1922, New York and London, D. Appleton and Co., p. 141. (10) *Le Blaye, M. R.:* Gynéc. et Obst. 17: 40, 1928.   (11) *Moench, L. M.:* Thrush of the Cervix Uteri, Med. Clinics of North America, May, 1929, Philadelphia, W. B. Saunders Co., pp. 1581-1583.   (12) *Davis, C. H.:* AM. J. OBST. & GYNEC. 18: 716, 1929.   (13) *Heard, E. L.:* Texas State J. Med. 24: 357, 1928-29.   (14) *Popoff, N. W., Ford, F., and Cadmus, W. H.:* AM. J. OBST. & GYNEC. 18: 315-321, 1929.   (15) *Odland, H., and Hoffstadt, R. E.:* Arch. Dermat. & Syph. 20: 335-338, 1929.   (16) *Flusser, E.:* Monatschr. f. Kinderh. 43: 123-129, 1929.   (17) *Perazzi, P.:* Centralbl. f. Gynäk. 52: 3069-3072, 1927.   (18) *Cordey, F.:* Comp. rend. Soc. de biol. 89: 501, 1923.   (19) *Castellani, A., and Taylor, F. E.:* J. Obst. & Gynec. Brit. Emp. 32: 69, 1925.   (20) *Castellani, A.:* J. Trop. Med. 19: 89, 1916.   (21) *Stephan, S.:* Monatschr. f. Geburtsh. u. Gynäk. 69: 65-69, 1925. (22) *Zweifel, P.:* Lehrbuch der Geburtshülfe, ed. 4, 1895, Stuttgart, p. 289.   (23) *Colpe, J.:* Arch. f. Gynäk. 47: 635-645, 1894.   (24) *Abraham, O.:* Monatschr. f. Geburtsh. u. Gynäk. 31: 89-101, 1910.   (25) *Giulini, P.:* Centralbl. f. Gynäk. 15: 1049-1050, 1891.   (26) *Mettenheimer, C.:* Memorabilien 25: 6-14, 1880.   (27) *Mettenheimer, C.:* Ztschr. f. rationelle praktische Aertze. 27: 1-3, 1882.   (28) *Menge, C., and Opitz, E.:* Handbuch der Frauenheilkunde. Wiesbaden, 1913, J. F. Bergmann, p. 531.   (29) *Mettenheimer, C.:* Memorabilien 17: 199-203, 1882.   (30) *v. Herff, O.:* Ueber Scheidenmykosen (Colpitis Mycotica Acuta). Samml. klin. Vortr. Gynäk. n. F., 34-67, 1894-1897. (Klin. Vorträge, n. F., No. 137, Gynäk., No. 52), October, 1895.   (31) *Seely, M. S.:* Texas State J. Med. 24: 357, 1928-1929.   (32) *Castellani, A., and Chalmers, A. J.:* Manual of Tropical Medicine, ed. 3, New York, 1919, p. 1085.   (33) *Davis, C. H.:* AM. J. OBST. & GYNEC. 18: 196, 1929.   (34) *Cooke, W. R.:* Texas State J. Med. 24: 357, 1928-1929.   (35) *Faber, H. K., and Clark, E. B.:* Am. J. Dis. Child. 34: 408-417, 1927.   (36) *Tanner, F. W., and Bollas, G. D.:* Proc. Soc. Exper. Biol. & Med. 26: 154, 1928.   (37) *Greenhill, J. P.:* AM. J. OBST. & GYNEC. 16: 870, 1928.

Mussatow, N. A.:   Intrauterine Instillations in Gynecologic Therapy.   Monatschr. f. Geburtsh. u. Gynäk. 82: 204, 1929.

The author maintains that all women with gonorrhea and with uterine bleeding not due to malignancy can be cured by nonoperative measures. Many cases of sterility may likewise be treated conservatively. The use of intrauterine instillations is advocated because it stimulates tissues through the blood. The author employs silver preparations because they produce a marked local hyperemia and iodin solutions because they are useful as iodin-ion therapy. The author claims to have obtained excellent results in cases of salpingitis and uterine bleeding by this form of treatment.

J. P. GREENHILL.

A CASE OF FLOATING UTERUS WITH CALCIFIED PEDUNCU-
LATED FIBROIDS PRESENTING ANEURYSMS OF THE
AORTA AND RIGHT INNOMINATE ARTERY

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ACCORDING to Graves, pedunculated fibroids are not uncommon. The same author describes floating fibroids. These are subserous myomas that become detached from their pedicles and float out into the abdominal cavity. However no mention is made of the occurrence of a floating uterus. None of the standard textbooks describe such a condition. A search of the available literature fails to reveal a case in which the entire uterus floats freely in the abdominal cavity suspended aloft by an elongated cervix acting as a pedicle. Because of the rarity of the condition and the diagnostic difficulties it presented, the following protocol is reported.

S. R., aged sixty, a colored female, was admitted to the medical service of Lincoln Hospital on December 25, 1929. The patient, apparently, had been perfectly well until the morning of admission, at which time she became suddenly unconscious and fell to the floor. There was no history of previous similar attacks. On arrival at the hospital the patient regained consciousness but was unable to move her right arm and right leg. There was no story of vomiting; no urinary difficulties; and no abdominal pain. It was learned that she had had no bowel movement for three days. There was little of special significance in her previous medical history. She had had one pregnancy to term with death of the child in early infancy. There had been no miscarriages and venereal infection was denied. The family history was irrelevant.

Physical Examination.—The patient was an emaciated colored female, somewhat stuporous. The right side of her face was flattened. A marked *arcus senilis* was present. The right pupil was larger than the left, and was irregular and fixed. The left pupil reacted to light. The tongue deviated slightly to the right. There was an irregular expansile mass on the right side of the neck over which a systolic bruit could be heard. The lungs were clear except for a slightly prolonged expiratory note. The area of precordial dullness was enlarged both to the right and to the left. At the level of the sternal notch it measured 4½ cm. to the right and 7 cm. to the left of the midsternal line; at the level of the xyphoid it was 6½ cm. to the right and 9½ cm. to the left of the same line. A loud systolic murmur of musical quality was heard over the entire precordium. No thrills were felt. The radials were thickened and easily palpable. The blood pressure was 220/110. Abdominal examination revealed a large, stony-hard, nodular and non-tender mass in the right lower quadrant. It was freely movable and could be shifted to either side. Subsequently this mass was felt under the right costal margin, in the right inguinal region and in the left lower quadrant. On pelvic examination the vagina was found to be very long; the cervix was made out with difficulty, and the uterus was not felt. The large abdominal mass was not palpable on bimanual manipulation. Neurologic examination showed no definite evidence of a hemiplegia.
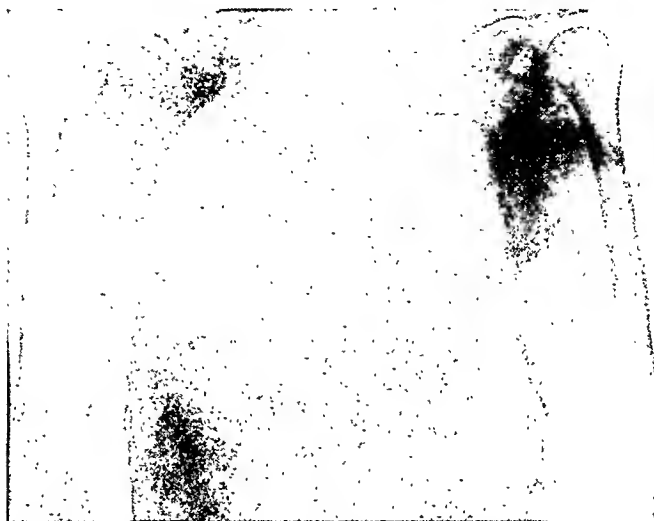
Fig. 1.—X-ray of the chest showing an aneurysmal dilatation of the aorta with calcified areas in the ascending aorta and aortic arch.
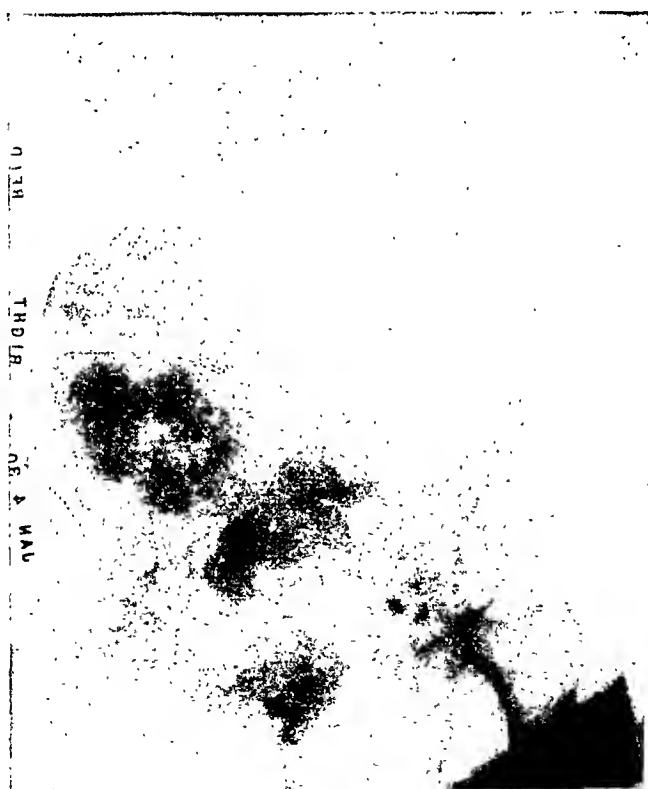
Fig. 2.—A flat plate of the abdomen taken after a barium enema, showing an opacity, not unlike an accumulation of barium in the cecum and ascending colon. This opacity was due to the calcified fibroid uterus.

Laboratory Observations.—The blood Wassermann was 4-plus with both the alcoholic and cholesterol antigens. The blood urea was 18.44 mg. per 100 c.c. The blood sugar was 0.173 per cent. A catheterized specimen of the urine showed a specific gravity of 1030, the reaction was acid and it contained a very faint trace of albumin and also a faint trace of sugar. The microscopic examination was negative. An x-ray of the chest showed an aneurysmal dilatation of the entire aorta with calcified areas in the ascending aorta and aortic arch. (Fig. 1.)

Fig. 3.—Pyelogram of the right kidney showing that the mass has no relationship to the right renal pelvis or calices.

Treatment and Course.—It was thought at the time that the abdominal mass represented a fecal impaction. The patient was put on oil enemas followed by colonic irrigations and was also given mineral oil by mouth. After a thorough trial of this régime had failed to influence the size of the mass, a flat x-ray plate of the abdomen was taken. This revealed on opacity in the right side of the abdomen not unlike an accumulation of barium in the cecum and ascending colon, this, despite the fact that the patient had not received a test meal. A barium enema was then given but was not retained completely. (Fig. 2.) On January 10, following the administration of magnesium sulphate the patient had a spontaneous bowel movement. Catharsis produced no change in the size of the mass.

On the assumption that the tumor might be a gummatous infiltration, large doses of potassium iodide were given. This therapy was ineffectual. At this time, after further x-ray study, Dr. Gottlieb reported that the mass had no relationship to the cecum or ascending colon. It was then suggested that we might be dealing with a calcified kidney. Cystoscopy was done and a pyelogram of the right kidney was taken. This showed that the mass had no relationship to the right renal pelvis or calices. (Fig. 3.) Following cystoscopy the patient developed a low grade fever, gradually became weaker and died on February 25, 1930.

Postmortem Findings.—The body was emaciated and weighed about 90 pounds. There was no edema or jaundice. The pleural cavities and the pericardial sac showed no excess of fluid or adhesious. The heart showed hypertrophy of the walls more marked on the right side. The cavities were moderately dilated. At the base of the aortic valve there was an ulceration of the endocardium measuring about 1 cm. across. From the aortic leaflets to the proximal portion of the descend-

Fig. 4.   Fig. 5.

Fig. 4.—Anterior view of the uterine mass showing the pedunculated fibroids.

Fig. 5.—The body of the uterus has been incised longitudinally and a probe has been inserted through the external os. It is seen emerging from the internal os into the uterine cavity.

ing abdominal aorta, there was found a marked dilatation of the wall with severe scarring, puckering, and placque formation of the inner surface. An aneurysmal bulge was observed in the descending portion of the aortic arch. The right innominate artery showed marked dilatation with thinning and bulging of the wall. The lungs, liver, spleen, pancreas, stomach and intestines showed no pathology. The left kidney presented some scar-formation and its capsule stripped with difficulty. The right kidney contained multiple cortical abscesses, several of which had perforated through the capsule and were surrounded by adhesions. No abscesses were found in the medulla. The pelvis of the right kidney was injected but the ureter was patent.

The uterus lay free in the abdominal cavity, suspended by an elongated cervix (12½ cm. in length) which had the appearance of a thinned-out sheet of mesentery.

The vaginal canal was likewise elongated and measured approximately 11 cm. in length. The body of the uterus was considerably deformed by intra- and extramural calcified myomas. (Fig. 4.) Two pedunculated fibroids extended upward from the uterus. Both of these were completely calcified and could not be sectioned with a sharp knife. The cervical canal was patent and a probe could be passed upward into the cavity of the uterus without any difficulty. (Fig. 5.) The adnexa showed no pathology.

Anatomic Diagnosis.—(1) Syphilis; (2) syphilis of the aorta with aneurismal dilatation; (3) generalized arteriosclerosis; (4) aneurism of the right innominate artery; (5) calcified fibroid uterus; (6) cortical abscesses of the right kidney; (7) ulceration of the endocardium at the base of the aortic leaflet.

COMMENT

This case presented many interesting features. Although the history as related by the patient was not completely reliable it is quite definite that the abdominal mass gave no symptoms. Marked obstipation of several days' duration led to a firm belief that the mass was produced by a fecal impaction. Cabot has already pointed out that the diagnosis of fecal impaction is usually an erroneous explanation of any abdominal tumor. It proved to be so in this case. The probability of a gumma of an abdominal viscus was seriously considered, because of the clinical and serologic evidence of syphilitic infection. Failure to change the size of the mass by the administration of large doses of potassium iodide militated against this diagnosis. Early x-rays, showing an opaque mass, suggested a tumor of the cecum or even a calcified kidney but these possibilities were excluded by further study. To complicate our problem, pelvic examination tended rather strongly to negate the probability of any gynecologic pathology.

CONCLUSION

A study of the foregoing case shows that a mobile tumor of the abdomen may be a floating uterus. Furthermore, if a uterus is not palpable on bimanual examination there is a possibility that its position may be altered by an elongated cervix.

1964 GRAND CONCOURSE.

190 ALEXANDER AVENUE.

THE MIOSTAGMIN REACTION IN THE DIAGNOSIS OF UTERINE CANCER

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IN A RECENT paper, Green[1] reported very favorable results on the application of the miostagmin reaction in the diagnosis of tumor. He obtained a positive reaction with carcinoma and a negative one with human sarcoma. Such results suggested the use of this reaction, particularly for the determination of the presence or absence of carcinoma in the radium-treated uterine cancer cases in Dr. George Gray Ward's follow-up clinic.

The miostagmin (*meion:* less; *stagma:* drop) reaction depends upon the reduction of surface tension of certain sera in the presence of an "antigen," thereby giving an increased number of drops as measured by a special pipette, the Traube stalagmometer.

In 1910, Aseoli[2] first applied this reaction to the diagnosis of typhoid fever. He believed the reaction to be specific, since the diluted antigen (alcoholic extract of typhoid bacilli), mixed with a diluted typhoid immune serum, gave a definite reduction in surface tension as compared with a normal serum. Since that time, numerous investigators, employing various so-called antigens, have extended the application of the reaction to the diagnosis of malignant tumors. Grevé,[3] in 1924, used the saturated fatty acid, normal caproic acid, as the antigen because of its stability, and obtained a positive reaction in all of his carcinoma cases.

The miostagmin reaction is obviously not specific, since a positive reaction may be obtained in certain conditions other than carcinoma, such as in pregnancy, nephritis, cirrhosis of the liver, arthritis, uremia, advanced pulmonary tuberculosis, and in many feverish conditions. Nevertheless, these conditions can be readily recognized and do not detract from the value of this reaction in those cases in which the miostagmin reaction may be an aid to the clinical observations in making a proper diagnosis. In this paper, it will be shown that the miostagmin reaction may be useful in determining the prognosis of many cases of radium-treated uterine cancer.

Green states: "The large number of authors who have employed the miostagmin reaction for the diagnosis of cancer unanimously agree that the reaction is of indisputable value and has already been observed by Roosen and Blumenthal and later by Burmeister, 'a decidedly negative reaction is of more value than a positive one and may be considered of some weight in ruling out carcinoma.' 'Of all cases of carcinoma examined, not one gave a negative reaction.' (Grevé.) The assertion of this author is also confirmed by Wissing thus: 'There is not the least

doubt that the reaction will give valuable diagnostic information where the usual method of investigation fails.' Kelling emphasizes the importance of the reaction as a great practical aid, especially in differentiating between malignant and benign growths of the digestive tract.

"One of the most important requisites of the miostagmin reaction seems to be its very early appearance as compared with the other means of investigation at our disposal. 'The sensitivity of the reaction is a relatively great one in that the reaction in an early stage may already be positive' (Waterman). This has also been confirmed by Wissing, who says: 'In each of 9 patients with carcinoma varying from the size of a cherry to that of a walnut, all gave a marked meostagmin reaction.' Wissing also notes that 'The most important fact is that the miostagmin reaction is also negative in all those clinical conditions which could be easily mistaken for cancer, such as benign tumors, gastric ulcer, chronic enteritis and colitis, ulcus cruris, in surgical tuberculosis without fever, in chronic inflammation of the female genital organs, and in syphilis.' One might also add 'in sarcoma.'"

Green's own work with the Grevé antigen and the Traube stalagmometer gave the following results:

"Out of 25 cancerous sera, 23 gave a positive and 2 a negative reaction; of 25 sera in which carcinoma was clinically excluded, 8 gave a positive and 17 a negative reaction; 7 sarcomatous sera all gave a negative reaction; and 16 normal sera all reacted negatively."

METHOD

In this study Grevé's antigen and technic were employed.

The antigen, normal caproic acid (Eastman Kodak Co.), was diluted with 0.85 per cent NaCl solution in the ratio of 0.1 c.c. antigen to 220 c.c. saline solution. This diluted solution of antigen will be designated hereafter as "antigen solution." The test is made by adding 9 c.c. of 0.85 per cent NaCl solution to 1 c.c. of serum in a test tube. This acts as the control. In a second test tube, 9 c.c. of antigen solution is added to 1 c.c. of serum. Both tubes are heated at the same time for one hour at 50° C. and cooled spontaneously for two hours at room temperature. The count is then made with the Traube stalagmometer for both the control serum and the antigen treated serum. *Normal sera should give a difference of less than two drops; whereas carcinoma sera, more than two drops.*

The above information is insufficient for obtaining proper and reproducible results. It is essential for the attainment of precision that will permit satisfactory reproducibility of results that all conditions should obviously be comparable. Therefore, to attain good precision, it is necessary that the following precautions should be observed:

1. *Clean Glassware.*—All glassware should be properly cleansed with chromic acid solution, washed thoroughly, and rinsed with distilled water. The stalagmometer should be cleansed between each run of control serum and antigen treated serum—first with water (sucked through), then chromic acid, followed by several washings with distilled water. Drying may be hastened by cautiously heating the bulb and stem of the stalagmometer with a Bunsen burner to the point barely tolerable to the fingers. The surface of the stalagmometer at which point the drop of diluted serum forms, should under no circumstances be touched by the fingers. Greasing of this surface vitiates the results, since the surface will not be wet alike by the control serum and the antigen-treated serum. No alcohol or ether should be employed for drying the apparatus, inasmuch as a slight amount of these chemicals will, of their own accord, reduce surface tension of the diluted serum.

2. *Preparation of Solutions.*—The saline solution is prepared from some high-grade analytical or recrystallized C.P. sodium chloride.* The distilled water should be boiled before use, cooled quickly, and used immediately, or else should be stored in a container well stoppered. Sufficient saline solution is made up so that a portion can be used for the preparation of the antigen solution. It is very important that *exactly* 0.1 c.c. of the n.-caproic acid should be measured out and diluted with 220 c.c. of 0.85 per cent saline solution. As a further additional precaution to check the purity of the n-caproic acid, the proportions as given above should strictly be adhered to; in addition, runs should also be made on a normal serum or sera with slight alteration of the antigen content. This can readily be accomplished, for example, by the addition of 1 c.c. of saline solution to the 1 c.c. of serum before the addition of the 8 c.c. of antigen solution to make the necessary 1:10 dilution. If the values for the drop difference for normal sera are about 1.5 drops, one can then be assured of having proper reagents for doing the miostagmin reaction.

3. *Stalagmometer Readings.*—The whole number of drops can readily be counted, but since a fraction of a drop throws a result either to the positive or negative direction, it is very essential that the *starting-point* should be identical in all cases and that the *end-point* should be read just when the drop has left the stalagmometer with the meniscus of the diluted serum still somewhere in the lower calibrated capillary portion of the stalagmometer.

(a) The starting-point may be attained first by lightly touching a clean, dry filter paper to the drop-formation surface and carefully wiping with filter paper the ground edge; then the diluted serum should be permitted to descend just to the top mark in the upper calibrated capillary portion of the stalagmometer; finally a clean, dry glass rod ($\frac{1}{4}''$ in diameter) is carefully brought up to the partial drop with the long dimension of the rod parallel to the drop-formation surface of the stalagmometer. The drop is squeezed to within a millimeter of the drop surface of the stalagmometer and the excess of the drop is removed by the withdrawal of the glass rod. This method insures good reproducibility, as demonstrated by a number of runs made on the saline solution.

(b) The end-point is read while the diluted serum is still in motion. With a little practice, one can determine the meniscus reading in the lower calibrated capillary, just when the drop leaves the surface. Previous calibration with our own stalagmometer showed that 21 divisions were equivalent to one drop. If the drop came off above the entirely circumscribed end-point, then the required number of divisions were added to bring the result to the fixed definite volume. On the other hand, if the drop came away at a point where the reading on the capillary was below the circumscribed end-point, then just so many divisions were subtracted from a whole drop. By this method one could determine the end-point very precisely—the error might at times be 5 per cent of a drop.

4. *Temperature.*—One assumes that if the surface tension of both the control and the antigen sera were determined at the same room temperature, then the requirements of precision would properly be satisfied. Such is not the case. Experimental data, derived with my serum, indicate that the higher room temperature as encountered in our laboratory may cause a marked error. The necessary temperature correction is shown in Table I.

The numerals under columns ''Saline'' and ''Antigen'' indicate the requisite number of divisions to be subtracted from respective readings in order to correct to 25° C. (N. B. 21 divisions equal 1 drop.)

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*In this work, Merck's C. P. sodium chloride was employed.

Of course, if· the apparatus and sera could be immersed in a thermostat, then all the data would be obtained under identical temperature conditions and the necessity for temperature corrections would thereby be avoided. A number of temperature curves should be made for various normal and pathologic sera to obtain the approximately true curve for temperature correction. In our present work, we took the temperature of the diluted serum immediately after it left the stalagmometer, by the immersion of a thermometer in the fluid.

TABLE I

TEMPERATURE	SALINE	ANTIGEN
25.5° C.	2	3
26.0	3	6
26.5	5	9
27.0	7	12
27.5	8	·16 ·
28.0	11	19
28.5	13	23
29.0	16	27

5. *Blood Serum.*—When a dry sterile needle and syringe are employed, one need not be concerned with any special precautions for the withdrawal of blood from the patient's vein. But, as in our present series, to permit a large number of cases to be tested in the limited time at our disposal, the routine procedure of taking blood specimens should be modified in this respect, that dry sterile needles should be employed and the syringe should be carefully rinsed in two changes of sterile 0.9 per cent saline solution. If this procedure were not adhered to, then invariably some of the sera would show hemolysis owing to the alcohol retained in the needle when alcohol was employed for sterilizing it. The tourniquet should not be too tight or left on too long, since stasis does alter to a slight extent the protein concentration of the serum.[4] Hemolysis also increases the serum concentration. The samples of blood should preferably be drawn before breakfast, so as to avoid lipemia so frequently found in the ambulatory clinic patients. A light breakfast avoiding butter, cream, and fried stuff, will not interfere with the test as shown by our results in all of the tables. We were unable to draw any specimens of blood before breakfast in our cases. It is essential that the ambulatory patient or individual be at rest for at least twenty minutes before drawing the blood. Rowe[4] has shown a great increase in protein concentration in the serum even when an individual does no active work except walking about for a few minutes. The clinic patients were at rest for more than twenty minutes when blood specimens were drawn; whereas with the ward patients no such precaution was necessary, since the patients were already at rest in bed. Sera can apparently be stored in the ice box for at least two days without affecting the results of the test. Sera should be double centrifuged to avoid red cell contamination.

6. *Serum Dilution.*—The dilution of the serum in the test tube should· be done exactly in the same way for both control and antigen sera. The solution should be added to avoid bubble or foam formation. Proper mixing should be done gently by rotary motion, to avoid foam formation and wetting the cork. (All corks should be thoroughly boiled several times, to extract the tannin that might precipitate the proteins.) Foam formation is permanent, since the proteins, such as the serum-globulin and serum-albumin, go into the surface and become altered in character so that they are not readily modified by acid or alkali.[5]

7. *Temperature of Incubation.*—A double boiler should be employed for heating the sera at 50° C. One cannot emphasize too much the precaution of keeping the temperature as fairly constant as possible, since a rise in temperature above 50° C.

is of more influence than heating at 50° C. for a longer time. It ·was found that heating a mixed serum for an additional one hour at 50° C. increased the drop number by 0.1 drop. In one experiment the control and antigen sera were heated at 65° C., with coagulation showing in the antigen serum in less than ten minutes, as indicated by increased opalescence of the fluid. It was found that the control serum was also markedly and equally affected with regard to increase in drop number.

8. *Vibration and Air Disturbances.*—It is obvious that a working spot should be selected where little or no vibration of the table top occurs. If necessary, a thick rubber sheet, or layer of cork or felt should be put under the stand which supports the stalagmometer. To avoid air disturbances, I employed a perforated watch glass cover, which set over the 50 c.c. beaker. The lower end of the stalagmometer was inserted through the watch glass for a distance of one-third the depth of the beaker. By this means, air currents were avoided and, in addition, the drop tended to form ·in an atmosphere fairly well saturated with vapor by the excess of the diluted serum not drawn up into the stalagmometer.

9. *Rate of Drop Formation.*—Du Noüy[6] has shown that time is a factor in attaining equilibrium between the proteins in solution and those concentrating in the surface layer. He states, ''Most of the values (surface tension) so far published correspond to an unstable state in the course of evolution toward the equilibrium and only happen to give approximately constant value when the instruments used in the case of hanging drop methods were identical and when the time required for the formation of a drop and its fall is about the same. The concordance of figures does not in any way imply the identity of the values of the tensions, except when, all things being otherwise equal, the time required in the formation of each drop is the same for a large number of drops.'' He further points out that in a serum of 1/100 dilution the surface tension, as expressed in dynes, is diminished by 2.5 dynes in the first minute. ''According to whether a drop is formed in 10, 30, or 60 seconds, the value of the surface tension calculated from the drop weight will be somewhere on the curve between 66.5 dynes and 64.0 dynes.'' I have devised a new apparatus to permit a constant level of fluid in a portion of the stalagmometer so as to assure the same time requirement for drop formation for all of the drops. This work is reserved for a later paper.

APPLICATION OF MIOSTAGMIN REACTION

I. *Follow-Up Clinic of Radium-Treated Uterine Cancer* (Table II).— In this series of 64 cases, the miostagmin reaction was done on the same day that the patient was admitted to the hospital for examination. The reports of the follow-up clinic are those recorded for the examination of the patient on the same date that the test was made. In 45 cases, the test and the clinical condition of the patient agreed very well. Cases 10, 13, and 59 were borderline cases as far as the test was concerned and Case 30 would be classed doubtful, because of the presence of marked hemolysis in the serum. The positive result for Case 47 might be due to lipemia or a postoperative condition; Case 45 was postoperative; while Case 61 was due to lipemia, since the patient stated she had a very greasy breakfast. Cases 6, 42, 48, 54, and 56 might be explained as due to arteriosclerosis, as confirmed by results in Table III. Case 63 was a nephritic and also had a marked hypertension (260/100). The negative result for Case 33 agreed with the

TABLE II. FOLLOW-UP CLINIC OF RADIUM-TREATED UTERINE CANCER

(Woman's Hospital)

CASE NO.	AGE	DIAGNOSIS	RADIUM TREATMENT	REPORT OF FOLLOW-UP CLINIC	DATE OF TEST AND F.-U. CLINIC	M. R. DIFFERENCE IN DROPS
1	56	Carcinoma of uterus (corpus)	9/20/23	Feels fine; no complaints; no bleeding	4/24/29	1.8
2	55	Carcinoma of cervix—Class III	3/15/29	Feels well; carcinoma shrinking; no slough present	4/24/29	1.6
3	45	Carcinoma of cervix—Class III	8/12/27 2/16/29	Feels well; discharge rather profuse; slough diminishing; fair result	4/24/29	2.1
4	42	Adenocarcinoma of sigmoid 6/7/28 Adenocarcinoma of uterus—Class III	9/25/28	Stomach gradually larger; constipated; fullness on left side	4/24/29	2.3
5	41	Carcinoma of cervix—Class III	6/ 4/27	Clinically free from carcinoma	4/24/29	1.1
6	68	Glandular hyperplasia 5/20/21 Adenocarcinoma of uterus (fundus)	5/20/21 4/16/26	Excellent health; no symptoms; no bleeding	4/24/29	2.6
7	54	Adenocarcinoma of uterus; adenomyosis-uteri; nephritis, chronic	12/ 9/27	Very good health; uterus slightly enlarged; no evidence of any recurrence	4/24/29	1.4
8	60	Carcinoma of cervix—Class III Carcinoma of cervix—recurrent pyometra Carcinoma of cervix—recurrent	6/17/27 3/30/28 2/ 8/29	Slight spotting; slight bleeding to touch in vagina	5/ 1/29	1.8
9	37	Carcinoma of cervix (?)	11/ 1/27	No symptoms; uterus free; cervix contracted	5/ 1/29	1.2
10	61	Adenocarcinoma of cervix Involvement of stump—hysterectomy Carcinoma of cervix—recurrent	3/25/27 10/23/28	Excellent condition; no discharge; no bleeding; clinically free from carcinoma; some pain in lower abdomen	5/ 1/29	2.0
11	61	Carcinoma of cervix—Class III	8/ 5/27	Free from symptoms; no evidence of any recurrence of carcinoma	5/ 1/29	1.9
12	55	Adenocarcinoma of body of uterus	3/19/27	Considerable discharge	5/ 1/29	2.5
13	56	Carcinoma of cervix—Class III	2/24/28	Excellent health; no symptoms; no evidence of any recurrence	5/ 1/29	2.0
14	59	Carcinoma of cervix—Class III	6/ 5/28	Feels very well; no symptoms; normal condition of cervix and broad ligaments	5/ 1/29	1.9
15	40	Recurrent nodule in vaginal wall Carcinoma of cervix (Group I—Memorial)	11/27/28 10/ 5/28	Free from symptoms; pelvis clinically free from carcinoma; cervix healing and negative	5/ 1/29	1.7
16	55	Carcinoma of vagina; anemia—secondary	2/ 1/29	Slough diminishing	5/ 1/29	1.6

TABLE II—CONT'D

CASE NO.	AGE	DIAGNOSIS	RADIUM TREATMENT	REPORT OF FOLLOW-UP CLINIC	DATE OF TEST AND F.-U. CLINIC	M. E. DIFFERENCE IN DROPS
17	43	Carcinoma of cervix—Class III	11/2/28	No pain; slight slough present	5/1/29	1.9
18	56	Carcinoma of cervix—Class III	12/7/26	Considerable discharge; cervix free from carcinoma	5/1/29	2.4
19	56	Carcinoma of cervix—Class III	8/13/27 4/14/25	Excellent health; no complaints; no evidence of any recurrence	5/8/29	1.3
20	47	Carcinoma of cervix (Group I—Memorial) Class III	7/16/28	Some pain; no bleeding; margins of crater still active; considerable slough in crater	5/8/29	1.7
21	62	Carcinoma of cervix—Class III. Complete destruction of cervix / Carcinoma of cervix—Class II	11/27/28 4/5/29	Feels well; no symptoms; no discharge or bleeding; no pain; excellent result	5/8/29	1.9
22	60	Carcinoma of cervix—Class III	9/18/25 11/21/25	Excellent general health; free from carcinoma; pain in hip	5/8/29	1.9
23	56	Carcinoma of cervix—Class III (Group II—Memorial)	10/2/28	Not making satisfactory progress; pain in back	5/8/29	1.4
24	57	Thickening in cervix / Carcinoma of body of uterus	3/8/29 11/9/28 11/16/28	No bleeding; uterus normal	5/8/29	1.3
25	55	Carcinoma of cervix—Class III (Group II—Memorial)	7/17/28	Fixed mass appears at level of lower pole of left kidney; metastasis	5/8/29	2.5
26	57	Carcinoma of cervix—Class III / Localized, small nodule	6/15/28 10/26/28	Feels well; cervix free from carcinoma; no evidence of nodule found which formerly was in vaginal vault	5/8/29	1.0
27	51	Carcinoma of cervix—Class III / Recurrent nodule	4/15/27 11/30/28	No symptoms; feels fine; slight induration to broad ligament	5/8/29	1.6
28	60	Carcinoma of cervix—Class III	5/25/28	Cervix negative for cancer	5/8/29	1.5
29	60	Carcinoma of corpus uteri—glandular—Class III	6/19/23 5/22/25	Excellent general condition; clinically free from carcinoma	5/8/29	0.7
30	60	Adenocarcinoma of uterus	1/17/29	Appears much better; no complaints; gained 30 pounds; uterus freely movable—size of six months' pregnancy	5/15/29	2.1 Marked hemolysis

TABLE II—CONT'D

CASE NO.	AGE	DIAGNOSIS	RADIUM TREATMENT	REPORT OF FOLLOW-UP CLINIC	DATE OF TEST AND F.-U. CLINIC	M.R. DIFFERENCE IN DROPS
31	58	Carcinoma of cervix—Class III; syphilis	12/11/28	Feels well; no bleeding; no discharge; clinically free from carcinoma	5/15/29	2.2
32	41	Carcinoma of cervix—Class III	6/24/27	Feels well; clinically free from carcinoma (4/19/28—X-rays show metastases to lungs.)	5/15/29	1.3
33	48	Carcinoma of cervix—Class III Induration in anterior lip	11/15/27 3/12/28	Feels much better; condition satisfactory	5/15/29	1.6
34	43	Carcinoma of cervix; vesicovaginal fistula	11/10/27	Radiation not advised (5/29/29—local condition much improved)	5/15/29	1.6
35	52	Carcinoma of cervix—Class III	1/18/29	Feels well; no complaints; some pain on right side; no evidence of recurrence; clinically free from carcinoma below	5/15/29	1.9
36	43	Carcinoma of cervix—Class II Uterus—carcinomatous Recurrence on cervix Parametria—involved Pyometra—carcinoma of cervix—Class III Recurrence—Class III	11/17/23 4/18/24 12/18/24 4/3/25 10/20/25 2/19/25	Feels well; no complaints; cervix is clinically free from carcinoma	5/15/29	1.4
37	69	Carcinoma of cervix—Class III	9/19/27	No bleeding; clinically free from carcinoma	5/15/29	1.3
38	47	Carcinoma of cervix—Class III Nodule in left broad ligament Involvement of anterior vaginal wall	7/10/28 11/2/28 5/24/28	Cervix small, contracted; anterior vaginal wall involved, from cervix nearly to urethral orifice	5/15/29	2.5
39	75	Carcinoma of cervix—clinically Inflamed cervical tissue (Path. diag.)	4/9/29	(One month—postoperative); discharge moderate; good normal reaction for radium treatment	5/15/29	2.4
40	49	Carcinoma of cervix—Class III?	2/18/28	Clinically free from carcinoma	5/15/29	1.8
41	49	Carcinoma of cervix—Class III	2/7/29	No bleeding; complaint of white discharge; examination shows good progress in healing	5/15/29	1.8
42	61	Adenocarcinoma of uterus (Complete hysterectomy 8/10/28)	7/27/28	No complaints; feeling much better; no evidence of recurrence of carcinoma	5/15/29	2.3
43	50	Carcinoma of cervix Crater about cervical canal friable, bled easily Small mass in center of cervix bleeds to touch Small bleeding spot—vault of vagina	2/14/22 8/25/22 2/9/23 12/16/24	Feels well, looks picture of health; examination shows perfect result; entire healing; no infiltration; no evidence of disease to be felt	5/15/29	2.0 Slightly hemolyzed

TABLE II—CONT'D

CASE NO.	AGE	DIAGNOSIS	RADIUM TREATMENT	REPORT OF FOLLOW-UP CLINIC	DATE OF TEST AND F.-U. CLINIC	M. R. DIFFERENCE IN DROPS
44	30	Carcinoma of cervix—Class II Vaginal discharge	1/18/27 5/10/29	No evidence of any disease; still complains of pain in hips	5/22/29	2.1
45	30	Carcinoma of cervix—Class III or IV Anemia, secondary	12/31/28	Improving in health; cervix gradually shrinking (tubes and appendix removed two months ago)	5/22/29	2.4
46	43	Carcinoma of cervix—Class III	2/7/28	Excellent health; no symptoms; cervix free from carcinoma	5/22/29	1.7
47	44	Carcinoma of cervix	11/17/21	In hospital one month ago for herniotomy; cervix free from carcinoma	5/22/29	2.8 Serum very turbid
48	67	Adenocarcinoma of fundus Endometritis, chronic	9/23/27 11/7/27	General condition excellent; no bleeding; no evidence of any carcinoma	5/22/29	2.1
49	49	Carcinoma of uterus Recurrence of carcinoma of cervix	1/4/29 3/21/29	Complains of backache; 5/29/29—complains of pain in back and rectum; cervix has shrunken down; no evidence of any recurrence; sound passed, small amount of fluid escaped	5/22/29	2.3
50	56	Carcinoma of cervix (Group II—Memorial) Carcinoma of cervix; nodule	10/2/28 3/8/29	Considerable pain in back; moderate slough; apparently responding well to radium	5/22/29	1.9
51	37	Carcinoma of cervix	2/1/29	Feels well; cervix contracting	5/22/29	1.7
52	55	Carcinoma of cervix—Class III	3/15/29	Free from spotting; feels much better; cervix is shrinking	5/22/29	1.6
53	40	Carcinoma of cervix; Wassermann ++++ Vaginal discharge	12/15/22 2/27/23	Patient in excellent health; no symptoms; free from carcinoma	5/22/29	1.5
54	68	Adenocarcinoma of uterus (fundus)	4/16/26	No symptoms; feels very well; no evidence of recurrence	5/22/29	2.4
55	51	Carcinoma of cervix (inoperable) Carcinomatous tissue Extensive carcinomatous growth	7/12/29 12/6/19 4/16/20	Excellent health; free from carcinoma clinically	5/22/29	1.8
56	59	Adenocarcinoma of uterus (fundus) (Panhysterectomy 4/3/23)	6/23/22	In excellent health; no evidence of any recurrence of carcinoma	5/22/29	2.1

TABLE II—CONT'D

CASE NO.	AGE	DIAGNOSIS	RADIUM TREAT-MENT	REPORT OF FOLLOW-UP CLINIC	DATE OF TEST AND F.-U. CLINIC	M. R. DIF-FERENCE IN DROPS
57	47	Carcinoma of cervix	8/10/23	No symptoms; feels well; examination shows clinically free from carcinoma	5/22/29	1.8
58	43	Carcinoma of cervix—Class III	11/ 2/28	Cervix indurated (5/22/29); complains of pain in hips; involvement of right broad ligament	5/29/29	2.4
59	43	Carcinoma of cervix—Class II	10/11/27	Feels well; free from symptoms; cervix is irregular but soft	5/29/29	2.0
60	46	Carcinoma of cervix—Class III	12/10/26	Excellent health; no symptoms; cervix apparently free from carcinoma	5/29/29	2.4
61	54	Carcinoma of cervix—Class III Anæmia, secondary	3/14/28	Excellent condition; cervix contracted	5/29/29	2.8 Very greasy breakfast
62	31	Metastatic carcinoma in peritoneum. Probably secondary to ovarian carcinoma; laparotomy 5/3/29	None	Pelvic examination shows cervix enlarged; frequency of urination due to carcinoma	5/29/29	2.5
63	41	Carcinoma of cervix—Class III; Anemia, secondary (heavy trace albumin in urine)	5/28/26	Free from symptoms; cervix is freely movable; apparently free from carcinoma.	5/29/29	2.5
64	64	Adenocarcinoma of uterus (fundus) Watery, blood-tinged discharge Carcinoma recurrence in uterus	12/19/24 12/ 4/25 4/24/28	Had two small blood clots; considerable discharge; cervix moderately shrunken; slough present over it with discharge about it; advised to enter hospital	5/29/29	2.7

clinical report, but did not explain the metastases in the lungs. For Cases 20, 23, and 60, there was a marked disagreement between the clinical condition and the result of the test.

In conclusion, 6 cases gave a positive reaction which might have been due to arteriosclerosis or nephritis, and 4 gave an incorrect reaction which was not in agreement with the clinical condition. Considering these 10 cases as in complete disagreement between the test and clinical condition, we obtained about 84 per cent correct diagnostic tests. Further, if in the light of the results in Table III, one considers the 6 positive cases as explained by arteriosclerosis, then about 94 per cent of the tests gave fairly good diagnostic aid. The disturbing fea-

TABLE III. FEMALE CHRONIC CASES (MONTEFIORE HOSPITAL)

CASE NO.	AGE	BLOOD PRES- SURE	CONDITION	DATE OF TEST	M. R. DIFF. IN DROPS
1	67	180/ 92	Myocarditis; general arteriosclerosis; hypertension	5/24/29	3.4
2	78	166/142	Senility; general arteriosclerosis; hypertension	5/24/29	1.8
3	63	160/ 84	Hemiplegia; arteriosclerosis	5/24/29	2.0
4	67	160/ 80	Hemiplegia; general arteriosclerosis; hypertension	5/24/29	2.1
5	46	296/146	Hemiplegia; hypertension	5/24/29	2.6
6	66	250/110	Hypertension; general arteriosclerosis. Amputation leg (arteriosclerotic gangrene)	5/24/29	1.3
7	69	158/ 75	Arthritis; general arteriosclerosis	5/24/29	3.1
8	60	125/ 70	Arteriosclerosis; auricular fibrillation	5/24/29	2.5

ture, nevertheless, is that a negative result was obtained in 3 really positive cases of recurrence or continued presence of a malignant condition.

II. *Female Chronic Cases* (Table III).—This series of 8 cases was made as a control on those patients fairly well advanced in years and who gave a positive reaction, whereas the clinical condition was at variance with these positive results. Arteriosclerosis does give a high result of positive reaction very likely due to increased cholesterol content, but not all arteriosclerotic cases give a positive reaction. About 65 per cent of the cases gave a positive reaction, as due to arteriosclerosis.

III. *Surgical Ward Cases* (Table IV).—In the various conditions found among the 79 patients tested in the wards, 3 were classed as doubtful, since the miostagmin reaction equalled 2.0 drops, and 6 positive without explanation as far as our present knowledge is concerned—no leucocytosis, no milk injection, no transfusion, no postoperative condition, and no temperature elevation. Excluding the 3 doubtful cases, about 93 per cent of the cases gave a correct miostagmin reaction.

IV. *Pregnancy and Postpartum Cases.*—In the 10 cases tested in the prenatal clinic and in the ward, the miostagmin reaction, ranging from 2.7 to 4.1, was not only positive but was also on a much higher level than that listed for the malignant cases in Table II. Even after the evacuation of the uterus, the positive reaction persisted at least for a week. How early in pregnancy one can obtain a positive miostagmin reaction remains to be learned by further work.

V. *Sarcoma Cases* (Table V).—Three of the cases gave a negative reaction; 2 definitely positive without any known condition to explain

TABLE IV. SURGICAL WARD CASES (WOMAN'S HOSPITAL)

DIAGNOSIS	MIOSTAGMIN REACTION		
	POSITIVE	NEGATIVE	DOUBTFUL
Carcinoma of cervix	2		
Carcinoma of ovary	1		
Adenomyosis at tubal angle	1*		
Dermoid cyst of ovary	1*	1	
Myoma uteri	2*	16	
Benign polyp in fundus of uterus		1	
Cyst of ovary	1†	2	1
Salpingitis, acute	1		
Salpingitis, chronic		2	
Salpingo-oöphoritis, acute	4		
Salpingo-oöphoritis, chronic		6	
Tubo-ovarian abscess (no fever)		1	
Abscess of abdominal wall (no fever)		1	
Hyperplastic endometritis		2	
Prolapsed uterus		3	
Retroversion of uterus	1*	6	1
Cystocele and rectocele	1*	2	1
Laceration of cervix		3	
Erosion of cervix		4	
Vaginitis senile		1	
Postoperative cases with fever	5		
Abortion	4		
Retained secundines		1	

*Positive reaction unexplained.
†Blood transfusion on same day of test.

TABLE V. SARCOMA CASES (MEMORIAL HOSPITAL)

CASE NO.	SEX	AGE	CONDITION	DATE OF TEST	M. R. DIFF. IN DROPS	REMARKS
1	Male	27	Chondrosarcoma	5/27/29	1.8	Radium treatment 5/16/29
2	Male	19	Osteogenic sarcoma of femur	5/20/29	1.7	5th postoperative day
3	Female	39	Fascial sarcoma of leg	5/20/29	1.9	Radium treatment 5/19/29 to 5/21/29
4	Female	37	Osteogenic sarcoma of knee	5/27/29	3.0	Amputation 4/10/29. Coley's toxin, intravenously—5/25/29 and 5/27/29
5	Male	53	Neurogenic sarcoma of scapula	5/20/29	2.9	Normal temperature, but very weak condition. Expired one week later.
6	Male	59	Metastatic lymphosarcoma	5/20/29	3.8	5/20/29 Normal temperature; 84,800 leucocytes, 90 per cent lymphocytes

the positive reaction except by the character of the metabolism in these really bad sarcoma cases. Case 4 may have given a high positive result because of the intravenous injection of Coley's toxin. Nevertheless, we must disagree, as far as these few cases indicate, with Green's statement that the miostagmin reaction is always negative in sarcoma cases.

THE NATURE OF THE MIOSTAGMIN REACTION

Various investigations by different authors have been made to ascertain the nature of the miostagmin reaction. Some authors believed a new substance, formed during the pathologic process, reacted with the antigen to reduce the surface tension; whereas others thought there was an alteration of the chemical composition of the serum Loeb[7] advanced the belief that a change of degree of dispersion resulted when the serum was heated—through absorption by the micelle. Weis-Ostborn and Ehrentheil[8] considered that the cholesterol content exerted an important influence upon the reaction; that a lowered cholesterol content of the serum produced a positive reaction, but that positive reactions could also be obtained with a high cholesterol content when this was partly obscured by the formation of globulin-cholesterol compounds (?). Calcium content of the serum seems to bear a direct relation to the surface tension as indicated by Svcila.[9] The surface tension of carcinomatous sera ranged from 47.8 dynes to 55.2 dynes per cm.; whereas that of normal sera ranged from 62.6 dynes to 65.3 dynes per cm. The calcium content in carcinomatous sera varied from 0.142 mg. to 0.22 mg. per c.c.; while that in normal sera varied from 0.226 mg. to 0.246 mg. per c.c.

Because of the complexity of the serum content, we believe that several factors should be considered in attempting to explain the nature of the reaction. The P_H of the diluted serum with and without the antigen throws light upon the problem. In addition, from the miostagmin reaction results obtained in the pregnancy and abortion cases, it seems that an increase in cholesterol content does give a positive reaction, since the positive reaction is at higher level than that of carcinoma cases. One can also see a direct relationship of calcium content to surface tension, since the calcium would combine with the saturated fatty-acid (antigen) to form an insoluble soap. Another factor which seems to play an important rôle is the content of the serum-globulin and serum-albumin and their ratio. We see, then, that no one single factor accounts for the nature of the reaction. The following experiments and observations are offered in an endeavor to ascertain the nature of the reaction:

1. *Antigen Solution.*—The drop reading at 25° C. of distilled water, 0.85 per cent saline and antigen solution were respectively 54-6, 54-2, and 60-8. These were not previously heated. One sees at once that the very dilute solution of antigen in 0.85 per cent saline in itself gives a difference of 5.7 drops when the 0.85 per cent saline is used as a control.

2. *Cholesterol Content.*—It is of interest to note that a hypercholesterolemia has been found in arteriosclerosis, nephritis, nephrosis, dia-

betes, obstructive jaundice, in early stages of malignant tumors, and in pregnancy. These are the very same pathologic conditions in which a positive miostagmin reaction has been obtained. Mattick and Buchwald[10] found a *higher cholesterol* content in plasma than in whole blood in 85 per cent of the patients with *cancer,* and a lower cholesterol content in plasma than in whole blood in 80 per cent of healthy patients. The results obtained in the arteriosclerotic cases as indicated in Table III seem to bear out the cholesterol increase as being the predominating influence in giving a positive reaction. Then, again, the high values obtained in the pregnancy cases seem to point to an increase of this constituent in the serum as contributing toward the high positive value. Finally, hemolyzed blood would give an increased cholesterol as well as protein content in blood serum.

3. *Serum-Albumin and Serum-Globulin.*—A very brief but interesting account is given by Robertson[5] concerning the surface tension of protein solutions.

"The influence of dissolved protein upon the tension of air-water surfaces has been investigated. Gelatin, egg-globulin and hemoglobin diminish the air-water tension. The diminution is greater the higher the temperature. . . . The surface tension of gelatin solutions and *blood serum* is increased by the addition of small quantities of alkali and *diminished* by the *addition* of *small quantities of acid.* . . .

"According to Bottazzi, the surface tension of serum-albumin solution is at a maximum when the ionization is at a minimum. . . . The *maximum depression of the surface tension of water by serum-albumin* occurs at a reaction just on the *acid side* of neutrality. Undissolved protein does not affect the surface tension of water when shaken up with it. . . . The surface tension of a protein solution which is so electrolyte-free as not to coagulate on heating nevertheless diminishes on heating. This reduction of surface tension is reversible, for on standing for some time at ordinary temperature the solutions regain their original surface tension. . . .

"The surface tension of protein solutions diminishes during digestion."

(a) A determination of the P_H values of the saline, antigen solutions, as well as sera diluted, gave the following instructive values:

1. 0.85 per cent saline solution — P_H 7.35 Bromthymol blue
2. Antigen solution — P_H 4.2 Bromcresol green
3. Serum diluted with saline and heated 1 hour at 50° C. (4 sera tested this way) — P_H 7.75 to 7.95 Phenol red
4. Serum diluted with antigen solution and heated 1 hour at 50° C. (12 sera tested this way) — P_H 6.0 to 6.5 Bromthymol blue
5. One c.c. serum + 6 c.c. antigen solution + 3 c.c. saline. Not heated. — P_H 6.5 Bromthymol blue
   Same heated 1 hour at 50° C. — P_H 6.55 Bromthymol blue
6. One c.c. serum + 9 c.c. antigen solution. Not heated — P_H 6.25 Bromthymol blue
   Same heated 1 hour at 50° C. — P_H 6.30 Bromthymol blue

Serum plus antigen gives a diluted serum just on the acid side which in turn gives the maximum depression of surface tension. One notes

the increased alkalinity of the serum plus saline. The P_H of normal blood serum ranges from 7.3 to 7.5. Exposure to air would account for the higher P_H value.

(b) Now, upon heating the diluted sera, it was found that at 65° C. for one hour, the antigen diluted serum became very markedly opalescent, since it was on the acid side, while the saline showed very little opalescence, because it was on the alkaline side of neutrality. Furthermore, the surface tension determinations gave the value of 61 + 2 drops at 27.2° C. for the antigen diluted serum, and 61-1 drops at 27.1° C. for the saline diluted serum. The values were practically alike; the decomposition or denaturing had advanced to the same degree irrespective of the presence of the antigen.

(c) Of additional interest is the work by Chick and Martin[11] on the coagulation of 3 per cent hemoglobin solution.

TEMPERATURE	COAGULATION TIME IN MINUTES	CONC. HEMOGLOBIN
60.0° C.	90	13.5
65.6°	20	11.0
70.4°	6	14.1

The temperature coefficient of the process is very high and explains why it is so important to control the temperature of incubation of the diluted sera. It also has been demonstrated that peptids are found among the products of protein hydrolysis. Temperature and acidity are therefore important factors in lowering the surface tension of diluted sera.

(d) Another point of interest is that protein solutions are usually characterized by the possession of a high viscosity. We endeavored to establish some correlation of the results obtained in the antigen diluted sera (heated) as obtained with chronic female patients' sera (Table III) with those obtained by a sedimentation test carried out as follows: One c.c. of the antigen diluted serum was mixed with 1 c.c. of 20 per cent suspension of washed sheep's cells. Westergren apparatus was employed.

SERUM	MIOSTAGMIN REACTION	SEDIMENTATION AT 25° C. IN MM. AT END OF 2 HOURS
G. H.	3.4	4.0
M. R.	2.0	4.0
P. P.	2.1	4.5
B. C.	2.6	3.0
S. R.	3.1	3.8
A. D.	1.3	5.0
R. C.	1.8	3.5
E. V.	2.5	3.3
Antigen Sol.		4.0
Saline Sol.		3.7

No direct relationship was found to be present between the results obtained by the miostagmin reaction and those by sedimentation. Perhaps suspended red blood cells from the same patient might have given a correlation of results.

(e) It has been found that the surface tension of a mixed serum did not give the average of the individual determinations of the sera going to make up the mixed serum. It usually was lower and suggested some agglutination of the proteins, or else diminished dispersion of some of its constituents, particularly the serum-globulin and serum-albumin fractions. Coca[12] has suggested trying a mixture of sera of individuals in the same blood group to determine the influence of mixing on the value of surface tension.

(f) Of further interest is the fact that when a diluted caproic acid solution of the same concentration employed for the miostagmin reaction, but without the presence of saline, was added to the serum, it caused immediate turbidity and subsequent flocculation resulted after a short time. The flocculated material was found to be globulin. That not all of the globulin was flocculated was proved by the addition of saturated $(NH_4)_2 SO_4$ solution to make a resulting one-half saturated solution, which caused additional globulin to be thrown out.

An experiment was performed to determine the influence of the absence of that amount of globulin thrown out by the diluted caproic acid. All the sera were heated for one hour at 50° C.

1.	Serum + saline	56 + 9	Difference = 2.4 drops
	Serum + antigen solution	58 + 17	
2.	Serum + distilled water	56 + 4	Difference = 1.3 drops
	Serum + diluted caproic acid without flocculated globulin	57 + 10	

All the proportions were the same as in the regular determination for surface tension. The only difference was that in No. 2 the diluting solutions contained no saline but the concentration of antigen was, however, the same.

This experiment, we believe, indicates the importance of the globulin fraction in the serum in contributing toward the diminished surface tension of a serum when heated, particularly in acid solution. We are inclined to think that it is this fraction of the proteins that is easily altered as to its degree of dispersion even in the presence of saline.

SUMMARY

1. The miostagmin reaction may be a useful diagnostic aid to arrive at a fairly accurate diagnosis if used in conjunction with the clinical observations.

2. The miostagmin reaction may be of prognostic value, especially in radium-treated uterine cases, provided the clinical picture is also taken into account.

3. Contrary to statements in the literature, a positive miostagmin reaction may be obtained in very malignant sarcoma cases.

4. It is believed that the nature of the miostagmin reaction involves several factors, such as cholesterol content and calcium content as well as serum-albumin and serum-globulin content. The P_H of the antigen diluted sera, along with other experimental data, seems to indicate that the proteins and the ratio of their constituents (serum-albumin and serum-globulin) are of great importance in influencing the surface tension value.

REFERENCES

(1) *Green, F.:* Canad. M. A. J. 17: 313, 1927. (2) *Ascoli, M.:* München. med. Wchnschr. 58: 62, 1910. (3) *Grevé, H.:* München. med. Wchnschr. 71: 1466, 1924. (4) *Rowe, A. H.:* Arch. Int. Med. 18: 455, 1916. (5) *Robertson, T. B.:* Physical Chemistry of Proteins, Longmans, Green & Co., New York, 1920, pp. 322, 347. (6) *Lecomte DuNoüy, P.:* J. Exper. Med. 35: 575, 1922; Surface Equilibria of Biological and Organic Colloids, Chem. Cat. Co., New York, 1926, p. 41. (7) *Loeb, L. F.:* Biochem. Ztschr., 1923 (136), 190. (8) *Weis-Ostborn and Ehrentheil:* Biochem. Ztschr., 1924 (148), 348. (9) *Sveila, K.:* Compt. rend. Soc. de biol. 94: 980, 1926. (10) *Mattick and Buchwald:* J. Cancer Research. 12: 236, 1928. (11) *Chick and Martin:* J. Physiol. 40: 404, 1910. (12) *Coca, A. F.:* Private communication to author.

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Isbruch, F.:   The Absence of Pathologic Organisms in the Uterine Cavity in Pregnancy.   Arch. f. Gynäk. 135: 108, 1928.

The pregnant uterus is entirely free from pathogenic organisms until labor sets in. The occasional positive finding is usually due to faulty technic. Shortly after labor sets in, however, organisms wander into the uterine cavity and can be found even in the decidua and in the placenta. It must not be forgotten that the presence of such pathogenic organisms does not necessarily mean infection for the given organisms may not be pathogenic for the given patient.

RALPH A. REIS.

PSYCHOTHERAPY IN A GYNECOLOGIC SERVICE*

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MY SUBJECT is psychotherapy in a gynecologic service. Permit me at first to emphasize that to you as individuals and as a group, an exposition of psychotherapy in gynecology can be nothing new. Although psychotherapists for the most part maintain that gynecologic psychotherapy differs in no way from psychotherapy in general, you have always been well aware of the particular and peculiar importance of it in a sphere in which the function, maturation, use, cyclical changes, and atrophy are all so closely linked to profound psychic changes. Any disturbance in function could thus have an emotional value out of all apparent proportion. Also there would be a strong tendency to project any psychic or autonomic disturbance to the genital zone. However, I thought it might interest you to hear of the application of certain psychotherapeutic principles on an actual gynecologic service rather than a purely theoretical discussion of an ideal, or the attitude of a single exponent.

This work was started in the out-patient department of the gynecologic service at Mount Sinai Hospital about twelve years ago. At first, two hundred and fifty suitable cases were studied. For the last five years the work has been incorporated into the regular organization of the whole service. A separate morning clinic has been established to which borderline cases are referred, women in whom the symptomatology is not accounted for by the physical findings. Similarly, cases on the ward with a functional element are interviewed by a member of this clinic. The correlation between the in- and out-patient departments offers an opportunity for long term observation in the out-patient department of cases we have seen on the ward, and vice versa, the hospitalization and close observation and study of the concomitant and intercurrent organic disorders occurring in patients seen in the out-patient department.

The principles we have followed can be briefly outlined. All attempts to reduce the matter to a formula would probably result in half truths of descriptive value only. We have, however, tried to keep in mind, first, the concept of a patient as a biologic unit as opposed to an addition of organ systems. As a corollary of this, presenting symptoms are considered not only as to their bearing on the organic diagnosis, but as to their relationship to the dynamics of the life of the patient (restated, this is to say, what value has this symptom

for this patient; technically, what is the morbid gain?). The interplay of complex conditioned reflexes, the functioning of the sympathetic nervous system, the reciprocity of the internal secretory glands to the above and to each other, and the effects of thought and wishes on all of them have forced us to accept the possibility that in a given case a smaller or a larger fraction of symptoms may be psychogenic.

A second principle was that the diagnosis of a psychogenic etiology of all or of any residue of the symptoms was never to be made solely by exclusion. We did not consider it enough to search for organic causes and upon failing to find one, retreat to the diagnosis of neurosis or hysteria. Together with the diagnosis by exclusion, we looked for a *positive* demonstration of the presence of psychic factors. Of course, we attempted to exercise a stern self-critique in the quantitative evaluation, for no one has completely been spared psychic traumata and no two people bear them equally well. Eliciting such data required much time and some patience and careful listening by a trained observer. We found that the ordinary history very frequently fails to tell the truth as to possible phychic etiology, since the patient comes with the idea that her condition is organic. Without entering into details of the special method of taking a history in a case, I might summarize the instruction to interns and residents in its briefest form as follows: "Get the patient's confidence, invite the history, listen to the patient, and watch her while listening."

A third principle involved the acceptance of the possibility that both organic and functional determinants of the symptoms can exist side by side, be interrelated, prolong or increase each other's effects. The pain, for example, caused by an actual gynecologic lesion may persist after the lesion has been removed or corrected if this pain serves a valuable purpose to the unconscious of the patient. Vice versa, a constant mental preoccupation with a certain zone, chronic anger, fear, etc., can favor local tumescence and, for example, prolong the existence of a discharge.

A fourth principle was, that everything said or done be considered and weighed in terms of the interpretation given it by the patient. We have seen cases in which the failure to take this into account has kept patients in chronic invalidism.

We have felt that there were two jobs to do:

1. To differentiate between organic and psychogenic determinants.

2. To treat both. To the patient it makes no difference whether her pain or disability is of one or the other category, and it seems insufficient to dismiss the patient because the absence of organic ills precludes danger to her life.

The scope and purposes of this division are:

1. To weed out all psychotics and psychoneurotics and to limit to a minimum operative interference on such patients.

2. To aid in the setting of indications as to type of operative inter-
ferences. As an example of this one might mention the evaluation
of the effect of tube ligation or castration, etc., on the subsequent life
of a woman.

3. As supplementary psychotherapy in patients with a combined
problem.

4. For the instruction of the younger men and postgraduate stu-
dents in a broader approach to the patient as a whole.

5. Suggestive and reeducational, and in some cases radical psycho-
therapy in the treatment of functional disturbances.

The psychotherapy per se can be divided in two:

1. That subtle unlabeled psychotherapy that starts from the moment
the patient is admitted and should continue without interruption until
and even after the patient's discharge. Here I would like to say that
I cannot lay too much stress upon the importance of the first or intro-
ductory words volunteered by a patient.

2. Specific psychotherapy, which is administered more consciously,
is best done by men specially trained and continued after discharge
from the ward. The particular school or particular label attached to
it, whether it originates in Vienna, Zurich, Berlin, or Baltimore, mat-
ters little. For the most part it is not what the therapist says that
counts as much as what the patient hears.

In the out-patient department we may more easily project our minds
over a long period of time. In our special morning clinic for the
study of frontier cases some men are being trained not to be over-
enthusiastic in leaping to either an organic or psychogenic conclusion.

Though I have differentiated between psychodiagnosis and psycho-
therapy it is perfectly true that in many cases an attempt at psycho-
diagnosis will have a therapeutic value. The opportunity given the
patient to tell her story completely in her own words, together with
the sympathetic and complete attention of the doctor, not only gives
valuable information, but permits the patient to get a perspective and
an insight, with a high therapeutic value. We try to bear in mind that
each patient presents to her doctor three intimately connected prob-
lems: the medical, the patient in relation to her body; the sociologic,
the patient in relation to her environment; and the psychologic, the
patient in relation to herself. Of the subdivision of the actual psycho-
therapy, I would like to discuss briefly the three main headings of ad-
justment, suggestive therapy, and radical therapy. (Please note that
I use the term adjustment in a special sense, far more limited than the
technical use of the word by mental hygienists.)

1. *Adjustment.* The patient and her environment are studied, her
potentialities and the possibility of the situation are estimated. An im-

partial attitude is assumed and advice given in an attempt (a) to alter the environment to suit the patient, or, (b) to get the patient to accept the environment.

Brief example to illustrate this principle: A young woman with a chief complaint of dysmenorrhea and fainting spells had a negative gynecologic examination. Invited to talk freely, it developed that due to her husband's being out of work, she had to live with her in-laws, who made life miserable for her. She felt that she had reached the end of her rope and was developing a series of symptoms in defense. She was sent to the country through the cooperation of the social service department. Her husband secured a position, she moved from her environment, and her symptoms disappeared.

2. *Suggestive Therapy.* This we have used in the form of (a) authoritative treatment, firm when the patient needs to lean on authority. It may be accompanied by definite commands or instructions and we feel that upon such suggestion rests the efficacy of many medicinal and manipulative treatments. The use of pessaries, cautery, tampons, etc., often have a purely suggestive beneficial value which seems legitimate in therapy as long as the doctor is conscious of what he is doing and why. (b) Gentle treatment. In such instances the patient is a child who wants and needs a mother (the sex of the gynecologist does not matter here).

We have not used hypnosis in hospital practice in spite of its undoubted value in some cases, for a number of reasons. It requires very special skill, it has inherent dangers in cases bordering on psychoses. In many cases its effects are very temporary, and it carries an aura of undeserved disrepute, widespread among both the laity and the profession. It differs from suggestion in degree rather than in kind.

The results of suggestive therapy in such conditions as pruritus vulvae, dysmenorrhea, pelvic pain, etc., are usually only temporary. The nasal cautery treatment for instance, relieves dysmenorrhea in a large percentage of cases, but the relief lasts through two periods on the average. This fact has strengthened our belief that it is purely a suggestive therapeutic procedure.

3. *Radical Psychotherapy.* In radical psychotherapy we attempt to remove the cause of the mental difficulty by either a rapid or a slow method. The choice of which, and the distinct limitations of each, are determined by the intelligence of the patient, her social status, her cultural resources, her moral fiber, the type of physician, the time at his disposal, the severity of the situation, and the definitive diagnosis.

To illustrate one of these factors, it may be important in one case to stop all medication and treatment in order to fully impress the patient with one's conviction as to absence of organic disorder, and in another to insist on some routine treatment or topical application of pessary changing, to insure regular observation until the suggestions or re-education have been adequately absorbed.

I shall give two examples in skeletonized outline illustrating the rapid and the prolonged type of radical psychotherapy:

A young woman complained of pain in the left breast; she had been to a doctor, who assured her there was nothing wrong. She was not satisfied. Examination of the breast, the heart, the whole woman was negative. (Here I may add that wherever a functional disturbance is suspected we feel that the indication for thoroughness in physical search is quadrupled.) I then asked what member of her family had cancer of the breast. She said, "My sister died of it and I have had my pain since." Then, knowing how often a cancerphobia is a symptom of a neurosis revolving about sterility, it was determined that her sister had had two children—the patient had none. She was envious of her sister and had identified herself with the sister. (I am simply giving a sufficient outline of the facts to indicate the trend.) She was then abruptly told that the real reason for her visit was sterility. The response was remarkable. "How did you know that I was going to talk to you about that, etc." The pain in the breast disappeared. Her sterility is being studied. In this case, the particular method of imparting to her the mechanism, with its touch of the dramatic, drove home the point with a valuable emphasis, and one brief interview was enough.

In the majority of cases it seems not only unnecessary, but unwise, to become involved in elaborate theoretical discussions with the patient in respect to mechanisms of the unconscious. Practical psychoanalysis, and for that matter practical psychotherapy, in general, are quite different from their theory. Let me put it in this way—the theory the physician should master and use *for* the patient and not *with* the patient. Illustrative case, radical therapy, prolonged treatment.

A woman of twenty-seven complained of severe dysmenorrhea as well as fainting spells, insomnia, attacks of nausea. Physical examination showed no local lesion, but did show a severe tic that she had had for twenty years. This had been diagnosed as chorea. Now, no chorea lasts for twenty years. A long conversation showed that this tic interfered with everything that the young woman might want to do—study, work, dance, marry, and so on. Her entire character had been warped and from my interviews with her relatives, I ascertained that we were dealing with a worth-while person suffering from a severe personality disturbance. A prolonged course of reeducational psychotherapy was recommended with the result that she became an efficient, attractive, sociable girl, minus the tic and minus the dysmenorrhea, incidentally. Please note that it was only incidental, as the initial diagnosis was that of a neurosis far more important to tackle.

Some of the symptoms we have frequently found to be functional are dysmenorrhea, irrespective of the position of the uterus, dyspareunia, vaginismus, frigidity, vague pelvic pain, excessive menopause symptoms, pruritus vulvae, tender ovary, backache, a feeling of protrusion in the absence of prolapse or cystorectocele, leucorrhea without pus and occasionally with pus, pains under the left breast associated with a sensation of something moving around in the abdomen, frank pseudocyesis, some cases of urinary frequency or urgency with clear urine and negative cystoscopic findings, some cases of incontinence of urine,

obstinate constipation, and some cases of amenorrhea and menorrhagia. Occasionally cases of irregular bleeding have been shown to belong to this group; on the whole this is unsafe teaching, however. It is true that under the influence of fright, from a contemplated vaginal examination or a set wedding date a premature period may occur, but on the whole in any case of metrorrhagia, we must have faith in a diagnostic curettage, even if the overwhelming majority of our pathologic reports read hyperplastic endometrium.

How far one goes in the direction of attributing these various symptoms to psychic causes will vary considerably. It has been the experience of the men who have worked most in this field that the more one investigates along this line the larger the variety of symptoms that have been found possibly due to functional disturbances.

One other thing—what has psychoanalysis to do with gynecologic psychotherapy? Let me emphasize that the term psychoanalysis refers to three distinctly different things. One, a formal, elaborate, long, difficult, psychotherapeutic method, one of a number of psychotherapeutic methods applicable to a small minority of mental cases. It should be done only by a well-trained man who has himself been analyzed and should not be accompanied with treatment for an organic ill at the hands of the same physician. The treatment precludes an advisory rôle, so if you hear that an analyst has advised this or that, you will know, either that you have been misinformed or that no real analysis has been done. At this point I would like to warn against the use of psychoanalysis in its many modified forms by untrained persons. Like any potent medicine that has the possibility for good, it has the possibility for harm, and anyone who does not understand thoroughly the divers manifestations of transferences and resistance will get into difficulties.

A second meaning of the term psychoanalysis as generally used is a body of knowledge acquired by means of psychoanalytic investigations and research, roughly grouped under the term "psychology of the unconscious."

The third definition of the term refers to a technic for investigating the mind which enlarges the armamentarium particularly in taking a history. Although the formal psychotherapeutic procedure is used practically rarely the passive modest utilization of information obtained in the interest of the patient through the knowledge of the principles, often proves valuable.

Permit me to mention one type of treatment showing the application of certain principles of the dynamics of a psychoanalytic cure in a nonanalytic treatment of dyspareunia and vaginismus. The treatment begins with the interdiction of all attempts at coitus. The physician then listens attentively and sympathetically with the fewest possible

words of interruption to the entire story with all its trimmings, including everything the patient is reminded of in her experience or fantasy. During this time the patient gets to like her physician. This is followed by a very brief and very gentle examination. The vaginitis is treated and this is followed by the gradual employment of a small speculum. The speculum is replaced subsequently by a test tube the size of which is gradually increased. The patient is then instructed to introduce the largest test tube herself. After this an explanation is given to the patient of what has transpired during the treatment, how her confidence in the physician has overcome her defense spasm. Then comes an interview with the husband, which includes the fullest discussion of his technical and psychologic approach. Then the patient is dismissed from further treatment or recommendation before coitus is attempted. In an analytic cure, the neurosis is converted into an analytic neurosis, and the patient then cured of that. In this case, analogously, the fear is converted into a medical fear, of which the patient is cured, to go out into the real world to reconvert and profit from it, the polarization now toward her husband.

I could, but need not, for this audience enlarge upon the importance of the sequence of events, the establishment and subsequent constructive displacement of the positive transference and the rôle of self-introduction of the large glass test tube.

The training advantageous to men who are interested in the organization of such work would include a certain amount of psychiatry and acquaintanceship with modern psychotherapy, knowledge of the resources of medical gynecology as aids in suggestion, knowledge of sex hygiene and the more common forms of sexual difficulties and incompatibilities, the possibilities and limitations of psychiatric social service work and a working knowledge of contraception and contraceptive problems.

We have availed ourselves fully of the closest cooperation with other departments of the hospital, particularly the departments of neurology and psychiatry, the mental health class and the social service departments. It might conceivably be argued that the availability of these departments would be sufficient to obviate the necessity, or discount the value of such work done within our own department. We have not found that to be so because of:

1. The very large number of such cases.

2. The tendency toward limitation to an organic approach by the neurologic department.

3. The tendency toward an excessive emphasis on psychogenic factors by the mental health department.

4. The perspective obtained by a worker in both fields.

In general it seems that the work has had the following results:

1. It has helped to limit and to clarify operative indications, eliminating almost entirely certain types of operation.

2. It has stimulated men in contact with the work on the wards in the direction of a new viewpoint.

3. It has done something quite specific for a group of patients who would otherwise have been left more or less to their own resources after having been diagnosed as neurotic.

4. It has given those who have spent their time in the investigation ample reward in the increased understanding of their patients, an increased tolerance of their oddities and an increased respect for the complexity of the whole psychophysical apparatus.

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Skajaa, K.: Cessation of the Coagulation of Blood in Postpartum Hemorrhage, "Shock Bleeding." Acta obstet. gynec. Scandinav. 9: 453, 1930.

In 13,000 confinements, Skajaa found 11 cases of postpartum hemorrhage in which the blood coagulated normally during labor. However, coagulation time was found to be fifteen to twenty minutes or longer, after the bleeding had ceased. When flow again started the blood did not coagulate at all. In 7 patients the uterus was firm and in 2 patients it was completely atonic. In all the patients there had been a preliminary abundant hemorrhage and in all but one there had been intrauterine manipulation. There were 4 cases of placenta previa and 3 of abruptio placentae. In most instances the bleeding began with noncoagulation of the blood and a change in the patient's condition resembling obstetric shock.

The uterine blood did not coagulate because it lacked fibrinogen. Blood taken from a vein coagulated in a normal manner. The uterus was the seat of a local hemophilia. The author believes that shock is the basis of this type of hemorrhage. The only way to treat this condition successfully is by vaginal hysterectomy. In 7 cases death occurred from hemorrhage. Four patients recovered after massive transfusions. J. P. GREENHILL.

TRICHOMONAS VAGINALIS VAGINITIS IN PREGNANCY*

. By P. Brooke Bland, M.D., Leopold Goldstein, M.D., and
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THE occurrence of *Trichomonas vaginalis* in the secretion of the vagina in the pregnant as well as in the nonpregnant woman has been reported by a number of European authors in recent years. Only a few investigators in this country; namely, DeLee,[16] Greenhill,[28] and C. H. Davis,[13] have made a clinical study of this interesting flagellated organism. Its morphology has been studied by several protozoölogists, notably by Hegner.[31] Although Donné[21] first described *Trichomonas vaginalis* in 1836, very little is definitely understood concerning its life history, morphology, transmission, and pathogenicity.

The presence of persistent abnormal vaginal secretion, leucorrhea of various types, and definite vaginitis in the pregnant woman led us to an investigation of the possible etiologic factor responsible for these conditions. The discovery of actively motile *Trichomonas* in fresh smears of the vaginal secretion of pregnant women directed our attention to this organism as a probable underlying cause. The present study was further undertaken because considerable doubt prevails concerning the pathogenicity of this flagellate. The material for the investigation was obtained from patients attending the antenatal clinic of the Jefferson Medical College Hospital. The morphologic study was made by Dr. David H. Wenrich, Professor of Zoology at the University of Pennsylvania.

Donné discovered this flagellated protozoön in the vaginal secretion and named it *Trico-monas vaginale.*

The incidence of *Trichomonas* in the vaginal secretion has been variously reported by numerous authors. All of the writers have observed this protozoön in the yellowish, cream-like, and markedly acid secretion of pregnant and nonpregnant women. In 1855 Koelliker[38] and a few years later Haussmann[30] found the parasite in from 40 to 50 per cent of gravid and nongravid women. Hoehne[33] noted the flagellate in the vaginal secretion of 34 per cent of 102 pregnant and in 28 per cent of 104 nonpregnant patients.

In 1913, Brumpt[8] found the parasite in 10 per cent of women in a gynecologic clinic in Paris. Wille[71] noted the organism in 40 per cent of women complaining of leucorrhea.

In recent years, Seitz[61] reported the flagellate in 20 per cent of pregnant women; Traugott[66] in 50 cent of nonpregnant women; Reuling[58] in 18.4 per cent of women with leucorrhea; and Ponoschina[52] in 16 of 29 adults manifesting profuse vaginal

discharge. Flaskamp[25] found that only one-third of the patients with *Trichomonas vaginalis* complained subjectively.

In 1928, Davis[13] and Greenhill[28] diagnosed and treated *Trichomonas vaginalis* vaginitis in 38 and 56 private patients, respectively. M. N. Andrews[2] recently found the organism in the vaginal discharge of 20 per cent of 100 women studied in England.

A flagellate apparently morphologically similar to the *Trichomonas* observed in the vagina, has also been observed in the urine of individuals of both sexes. Künstler,[39] in 1883, was seemingly the first to mention finding this organism in freshly voided urine. The first undoubted case of *Trichomonas* infection of the urinary tract of man was reported by Marchand[49] in 1894. Since then a number of writers; namely, Dock,[17] Miura,[50] N. S. Davis,[15] Arnold,[3] Rasmussen,[56] Lewis and Carroll,[41] Dastidar,[12] Căpek,[10] Visher,[68] Seitz,[61] and Flaskamp[25] have reported the occasional presence of this flagellate in the urine of both the male and female.

<div align="center">CULTIVATION</div>

Several methods have been recommended for the cultivation of *Trichomonas vaginalis* by workers who have cultured the organism with varying results. The media are generally similar, containing for the most part saline with nutrient material, such as fresh or dried serum or ascitic fluid. Lynch,[46] in 1915, was the first to cultivate the parasite with any degree of success, obtaining a growth in beef broth.

The most satisfactory results, however, have been secured with Loeffler's blood serum, diluted with citrated saline to which is added a small amount of fresh egg albumen to inhibit the rapid growth of bacteria. This combination was first used to cultivate various trichomonads by Tanabe[64] and Cleveland[11] in 1925. The composition of the medium, as used in the present investigation, is as follows:

Loeffler's (dehydrated) blood serum	0.5	gm.
Sodium chloride	0.7	gm.
Sodium citrate	1.0	gm.
Distilled water	100	c.c.
Egg albumen	5	c.c.

The medium is prepared in the following manner: The sodium chloride and sodium citrate are boiled in distilled water for ten minutes and allowed to cool. Loeffler's dehydrated blood serum is then added. This solution is citrated to P_H 7.6, and 5 c.c. of fresh egg albumen added. To maintain the protozoa free as possible from bacteria, the medium is then tubed and sterilized by the fractional method in the Arnold sterilizer at 90° C. for one hour daily for three days. A sterile tube of the medium is always available to receive the material collected from the patient in the following manner: A vaginal speculum is inserted without employing a lubricant, exposing the cervix to view. Using the lower blade of the speculum as a spoon, an effort is made to scoop up as much secretion as possible from the lake usually present in the posterior fornix and from the vaginal wall itself. This is transferred to a sterile tube containing one or two cubic centimeters of normal salt solution. A drop of the material is then examined under high power for living flagellates. The saline-secretion mixture is then poured into a tube containing the saline-citrate-serum solution and incubated at 37.5° C. The cultures are examined twenty-four hours later. Subcultures are made from all those showing a growth while those not showing any live organisms are permitted to remain in the incubator for twenty-four hours longer. If no growth appears at this time,

the tube is discarded. Since the trichomonads grow at the bottom of the tube with the bacterial sediment, it is necessary to withdraw the specimens from the precipitate with a capillary pipette for examination and for transfer to new tubes.

In the present investigation, cultures were prepared in the manner described from the vaginal secretion of all patients with positive smears. The organisms from 45 patients were successfully cultivated, subcultures being made daily. The cultures were preserved or maintained for five or six days and then discarded.

Smears were also made either from the secretion directly or from the preliminary saline mixture in all positive cases and fixed immediately in Schaudinn's sublimate alcohol. Each smear is fixed for fifteen minutes. It is then transferred to 50 per cent alcohol for twenty minutes and finally placed in 70 per cent alcohol where it remains until stained with Heidenhain's hematoxylin.

MORPHOLOGY AND LIFE HISTORY

The morphology of *Trichomonas vaginalis* has been presented by a number of writers since the original account given by Donné (1837), notably by Bensen,[5] in 1910, Reuling (1921), and Hegner (1925). All these later observers agree on the general features of organization of this flagellate, but there is some disagreement as to details.[*]

The only method of reproduction that has been observed in this study is binary fission, with details which parallel those recorded for other species of *Trichomonas*.

So far as the present observations permit of an opinion, it would appear that the characters already described for *Trichomonas vaginalis* serve to distinguish it from all other species of the genus. This is important in view of the fact that this is the type species of the genus and in view of the as yet unsolved problem of transmission from host to host. Although stool examinations have been made from only 4 of the patients positive for *Trichomonas vaginalis*, these were all negative for intestinal trichomonads. Therefore, an origin from some other source than the intestine is indicated for *Trichomonas vaginalis*.

CLINICAL OBSERVATIONS

Specimens collected at various times from 300 pregnant patients registering in the antenatal clinic revealed the presence of trichomonads in 61, or 21 per cent (Fig. 1). The actively motile flagellates were usually associated with many leucocytes, bacteria, and squamous epithelial cells. That the organism is a more common invader of the vagina of colored women is disclosed in Fig. 2. It is noted that 54, or 32 per cent, of the 164 colored patients showed *Trichomonas*, as com-

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*See articles in this JOURNAL by C. H. Davis, Vol. xviii, pp. 196, 575, and J. P. Greenhill, Vol. xvi, p. 87, also an article to be subsequently published by the author.

pared with 13, or 9.5 per cent, of 136 white patients. The marked variance in the percentages may be attributed to differences in the local hygienic condition.

Only 8 (13 per cent) of the patients with *Trichomonas* infection complained of local symptoms. Many others, however, on being closely questioned in this respect usually mentioned the existence of a profuse irritating or burning, yellow or white discharge. The vaginal secretion was materially altered in practically every instance from the usual milky white material, consisting of mucus and epithelium, to a

PERCENTAGE

POSITIVE – 61 PATIENTS

NEGATIVE – 239 PATIENTS
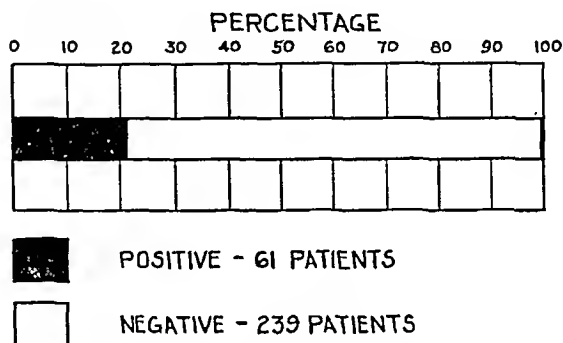
Fig. 1.—Incidence of *Trichomonas vaginalis* infection in three hundred pregnant women regardless of race.

PERCENTAGE

COLORED 164 PATIENTS

WHITE 136 PATIENTS

POSITIVE

NEGATIVE
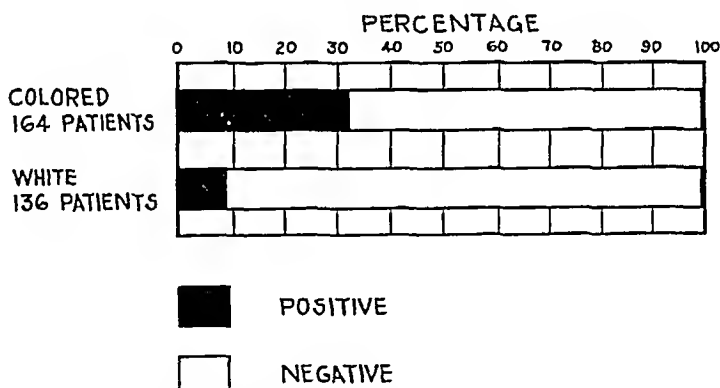
Fig. 2.—Incidence of *Trichomonas vaginalis* infection in three hundred pregnant women according to race of patient.

thick seropurulent, creamy yellow, and often bubbling or foamy discharge, containing numerous bacteria, trichomonads, and leucocytes. Several patients complained of pruritus and chafing in addition to profuse leucorrhea. On examination the external genitalia usually showed purulent discharge exuding from the introitus. The inflammatory phenomena ranged from a diffuse reddening of the vaginal wall and vestibule with frothy purulent discharge below the cervix to a more or less extensive intertrigo of the vulva and surrounding area. In severe cases the appearance of the vagina resembled (with the exception of the frothy character of the secretion) that of an acute

gonorrheal vaginitis. However, in none of the patients studied was the gonococcus an accompaniment, though a few authors (Loeser,[45] Flaskamp,[25] Seitz,[61] and Gragert[27]) have observed this dual infection. Hoehne, on the contrary, states that he has never noted the combination of gonorrhea with vaginal trichomoniasis.

TREATMENT

Several methods of treatment have been advocated which have for their aim either a biologic alteration of the bacterial flora or a destruction by chemical means of the *Trichomonas* itself. Regional prophylaxis should be practiced by proper cleansing of the anal region after defecation, although it has not as yet been determined with certainty that the intestinal tract is the source of the infection. Vigorous and repeated treatment is usually required before the vaginitis is relieved and the vaginal mucosa permanently freed of the parasite. The following plan of therapy has proved successful in the majority of cases: The anal region, vulva, and vagina are first thoroughly scrubbed with tincture of green soap, followed by sterile water, and then washed with 1 per cent compound cresol solution. The vagina is then dried with cotton pledgets and a tampon saturated with boroglycerin (10 per cent) is inserted and allowed to remain overnight. Hoehne recommends gelatin capsules containing 3 c.c. of the borated glycerin to be filled immediately before using and inserted by the patient herself. A 0.5 per cent lactic acid douche is prescribed daily for several weeks in order to reestablish the normal bacterial flora. The employment of a culture of organisms similar to the lactic acid bacillus has also been suggested (i.e., Bacillosan recommended by Loeser). This, it is claimed, disinfects the vagina biologically and promotes the growth of the selected organism which is antagonistic to other forms of germ life. Finally, the most important aspect of the therapeutic plan is found in vigorous mechanical cleansing.

Tampons of methylene blue have been used successfully by Greenhill; while DeLee has secured good results with glycerin and sodium bicarbonate tampons. The use of drying powder, such as kaolin, has also been recommended.

DISCUSSION

Many attempts have been made to determine directly whether *Trichomonas vaginalis* is the actual exciting cause of the colpitis or the leucorrhea with which it so frequently is associated. At the present time, no one has been able to prove conclusively that it is pathogenic, although this is the consensus of opinion among those who have observed and treated purulent vaginitis and persistent leucorrhea existing without apparent cause. Nevertheless, several workers among whom may be mentioned: Haupt,[29] Seeliger,[60] Loeser,[45] Füth,[26] and

Wolfring,[73] maintain that this parasite is only a harmless inhabitant of the vagina and not in the least pathogenic. Haupt insisted that the organism is nonpathogenic because the transmission of *Trichomonas* from the vaginal secretion to a normal woman failed to produce any inflammatory reaction or any changes in the character of the vaginal secretion, although large numbers of the flagellates were present.

An array of clinicians considers that *Trichomonas vaginalis* has a definite pathologic significance. DeLee, Greenhill, and C. H. Davis speak of *Trichomonas vaginalis* vaginitis as a specific entity; moreover, a larger group of authors in Europe has pronounced this organism as the factor in the causation of this condition.

Seitz and Hoehne contend that the parasite is often pathogenic in nature and that it also tends to increase the virulence of the bacterial flora in the vagina. The latter author was the first to associate this organism with purulent vaginitis, the strongest proof of his assertion being the fact that the organisms were so numerous in the pathologic discharge and that the vaginitis subsided as the trichomonads disappeared.

A definite vaginitis; i.e., subjective plus objective symptoms, was present in only 13 per cent of our series of patients, whereas almost all possessed an abnormal type of vaginal secretion. In our opinion *Trichomonas vaginalis* is not a harmless invader of the vagina but is pathogenic and under proper conditions; i.e., in association with other organisms, is capable of producing an inflammatory reaction exciting a pathologic exudation or discharge containing numerous leucocytes, and culminating occasionally in a pronounced vaginitis.

Several authors (Schmid, Kamniker, Liss and Gragert) have investigated the effect of *Trichomonas vaginalis* infection in pregnancy on the puerperal morbidity rate. These authors agree that the presence of a vaginal infection with this organism in pregnancy greatly increases the danger of puerperal infection. The puerperal morbidity rate of patients manifesting a *Trichomonas vaginalis* vaginitis antepartum was considerably greater than in those who did not exhibit this condition. It is as yet impossible to make any statement regarding the morbidity rate in our series of patients since only a small proportion of those studied have been delivered to date.

SUMMARY AND CONCLUSIONS

1. *Trichomonas vaginalis* was found in the vaginal secretion of 61, or 21 per cent, of 300 gravid women examined.

2. The morphology of the organism is briefly described. It is usually pear-shaped and ranges in length from 7 to 30 microns, while the width is usually one-half to two-thirds of the length. A slender axostyle projects posteriorly, four free flagella project anteriorly,

and an undulating membrane extends from the anterior end backward along the surface to about the middle of the body.

3. The parasite is a more common invader of the vaginal tract of the colored woman, being found in 54, or 32 per cent, of 164 colored patients; and only in 13, or 9.5 per cent, of 136 white patients.

4. Eight, or 13 per cent, of the patients with vaginal trichomoniasis complained of local symptoms.

5. Vigorous and repeated mechanical cleansing is the most important step in the treatment of the vaginitis associated with this parasite.

6. Finally, it is our belief that under suitable conditions the organism may assume pathogenic proclivities similar to other organisms, or in association with bacteria, may give rise to serious local or ascending infection of the genitourinary tract, particularly in the puerperium.

REFERENCES

(1) *Andrews, J. M.:* J. Parasitol. 12: 148-157, 1926. (2) *Andrews, M. N.:* J. Trop. Med. 32: 237-240, 1929. (3) *Arnold, M.:* Ztschr. f. Gynäk. Urol. 4: 215-221, 1914. (4) *Baatz, P.:* Monatsbericht. f. Urol. 7: 457-469, 1902. (5) *Bensen, W.:* Arch. f. Protistenk. 18: 115, 1910. (6) *Blochmann, F.:* Ztschr. f. wissensch. Zool. 40: 42, 1884. (7) *Boyd, M. F.:* J. Parasitol. 4: 168-170, 1918. (8) *Brumpt:* Précis de Parasitologie, Paris, 1922. (9) *Bütschlii:* Brown's Klassen und Ordnungen des Thierreichs, Vol. I, Part 2, p. 676. (10) *Căpek, A.:* Med. Klin. 23: 1535, 1927. (11) *Cleveland, L. R.:* Biol. Bull. 48: 455-468, 1925. (12) *Dastidar, S. K. G.:* Indian M. Gaz. 60: 160, 161, 1925. (13) *Davis, C. H.:* AM. J. OBST. & GYNEC. 18: 196-203, 1929. (14) *Davis, C. H., and Colwell, C.:* J. A. M. A. 92: 306-308, 1929. (15) *Davis, N. S.:* Chicago M. Rec. 10-11: 239-242, 1896. (16) *DeLee, J. B.:* Illinois M. J. 38: 186, 1920. (17) *Dock, G.:* Am. J. M. Sc. 111: 1-22, 1896. (18) *Dock, G.:* Medical News 2: 690, 1894. (19) *Doflein, F.:* Lehrbuch der Protozoenkunde, Jena, 1909, G. Fischer. (20) *Donné, M. A.:* Compt. rend. Acad. d. sc. 3: 385-386, 1836. (21) *Donné, M. A.:* Recherches Microscopiques Sur la Nature du Mucus, etc., Paris, 1837. (22) *Dujardin, M. F.:* Histoire naturelle des Zoophytes, Infusoires, Paris, Librairie Encyc. de Roret, 1841. (23) *Dujardin, F.:* Werke über Infusorien, Paris, 1841, p. 299. (24) *Escomel, E.:* Bull. Soc. path. exot. 5: 7, 1917. (25) *Flaskamp:* Arch. f. Gynäk. 125: 423-427, 1925. (26) *Füth, H.:* In Menge and Opitz's Frauenheilkunde fur Aerzte und Studierende, Wiesbaden, 1913. (27) *Gragert, O.:* Monatschr. f. Geburtsh. u. Gynäk. 64: 37-41, 1923. (28) *Greenhill, J. P.:* AM. J. OBST. & GYNEC. 16: 870-881, 1928. (29) *Haupt, W.:* München. med. Wchnschr. 71: 204-205, 1924. (30) *Haussmann, D.:* Die Parasiten der weiblichen Geschlehtsorgane des Menschen und einiger Tiere, A. Hirschwald, Berlin, 1870, 80. (31) *Hegner, R. W.:* Am. J. Hyg. 5: 302-307, 1925. (32) *Hegner, R. W.:* J. Parasitol. 14: 261-264, 1928. (33) *Hoehne, O.:* Zentralbl. f. Gynäk. 40: 4-15, 1916. (34) *Hoehne, O.:* Zentralbl. f. Gynäk. 40: 113-118, 1916. (35) *Hogue, M. J.:* Johns Hopkins Hosp. Bull. 33: 437-440, 1922. (36) *Kane, H. F.:* Virginia Med. Monthly 49: 393-395, 1922. (37) *Katsunuma, S.:* Bull. Soc. path. exot. 17: 216-217, 1924. (38) *Koelliker and Scanzoni, F. W.:* Beitr. z. Geburtsh. u. Gynäk. 2: 131-137, 1855. (39) *Künstler, J.:* J. de méd. de Bordeaux 13: 249, 1883-4. (40) *Künstler, J.:* J. Micrographic 8: 317-331, 1184. (41) *Lewis, B., and Carroll, G.:* J. Urol. 19: 337-339, 1928. (42) *Leuckart, R.:* The Parasites of Man, Y. J. Pentland, Edinburgh, 1886, p. 770. (43) *Liss, W.:* Monatschr. f. Geburtsh. u. Gynäk. 64: 31-36, 1923. (44) *Littauer, A:* Zentralbl. f. Gynäk. 47: 25-33, 1923. (45) *Loeser, A.:* Zentralbl. f. Gynäk. 46: 226-229, 1922. (46) *Lynch, K. M.:* Am. J. Trop. Dis., and Prev. Med. 2: 627-634, 1915. (47) *Lynch, K. M.:* J. A. M. A. 79: 1130-1133, 1922. (48) *Lynch, K. M.:* Am. J. Trop. Med. 2: 531-538, 1922. (49) *Marchand, F.:* Centralbl. f. Bakteriol. 15: 709-720, 1894. (50) *Ohira, T., and Noguchi, H.:* J. Exper. Med. 25: 341-347, 1917. (52) *Ponoschina, V. G.:* Russian J. Trop. Med. 1: 27-30, 1923; Abst. in Trop. Dis. Bull. 21: 773, 1924. (53) *Pringault, E.:* Bull. Soc. path. exot. 13: 1920. (54) *Prowazek, S.:* Arch. f. Protistenk. 1: 166, 1902. (55) *Prowazek.*

S.: Handbuch der pathogenen Protozoen, J. A. Barth, Leipzig, Vol. I, p. 78-88.
(56) *Rasmussen, A. A.:* Hospitalstid 69: 1177-1186, 1926. (57) *Reichenow, E.:* Arch. f. Schiffs - u. Tropen-Hyg. 27: 367-383, 1923. (58) *Reuling, F.:* Arch. f. Protistenk 42: 347, 1921. (59) *Schmid, A. L., and Kamniker, H.:* Arch. f. Gynäk. 127: 362-383, 1926. (60) *Seeliger, P. G.:* Inaug. Diss. Berlin, 1927, Abst. in Zentralbl. f. Gynäk. 51: 3149, 1927. (61) *Seitz, A.:* München. Med. Wchnschr. 66: 837-839, 1919. (62) *Stephan, S.:* Zentralbl. f. Gynäk. 45: 1565-1659, 1921. (63) *Stephan, S.:* Zentralbl. f. Gynäk. 46: 992-994, 1926. (64) *Tanabe, M.:* J. Parasitol 12: 101-104, 1925. (65) *Thomson, J. G., and Robertson, A.:* Protozoölogy, Wm. Wood & Co., New York, 1929, p. 376. (66) *Traugott, E.:* München. med. Wchnschr. 65: 386, 1918. (67) *Vavilova, N. M.:* Russian J. Trop. Med. 5: 513-520, 1927. (68) *Visher, J. W.:* J. A. M. A. 92: 2098-2099, June 21, 1929. (69) *Vorela, H. G., and Rubino, P.:* Prensa méd. Argent. 14: 781, 1927; Abst. in J. A. M. A. 90: 1338, April 21, 1928. (70) *Wenyon, C. M.:* Protozoölogy, Baillière, Tindall and Cox, London, 1926, vol. I, p. 660. (71) *Wille, O.:* Med. Klin. 14: 520, 521, 1918. (72) *Wertheimer, M.:* Virchow's Arch. f. path. Anat. 21: 314-336, 1861. (73) *Wolfring, O.:* Zentralbl. f. Gynäk. 45: 810-819, 1921.

1717 PINE STREET.

Solms and Klopstock: The Pregnancy Test of Aschheim and Zondek and Its Significance in the Differential Diagnosis of Amenorrheic and Climacteric Disturbances.   Deutsche med. Wchnschr. 55: 1919, 1929.

The authors report highly satisfactory results with this test in diagnosing pregnancy. There was practically no failure when the test was performed later than the eighth day after the missing menstruation. In a few cases a weak positive test could be obtained as early as three days prior to ·the expected menses. In the few cases in which the test erroneously was pronounced negative, the findings on dissection of the test animal were at least so dubious as to suggest the necessity of a check. On second trial all these urines gave finally a correct positive reaction.

The authors extended the application of this test for the differentiation of two types of amenorrhea and climacteric disturbances. Either condition is considered to be a dysfunction of the hormonal system with either hyper- or hyposecretion. By dividing the urine into a heated and nonheated portion the test can be further elaborated for the differentiation of ovarian and pituitary hormones as the latter will be destroyed by higher temperatures. Four cases are cited in order to demonstrate the possibility of discovering different and adverse hormonal concentrations in the urines of patients suffering from those conditions and the satisfactory therapeutic results derived from this refined diagnosis.

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STUDY OF NEONATAL DEATHS OCCURRING IN 6000 CONSECUTIVE DELIVERIES*

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A FEW years ago, a series of statistical studies was undertaken on the Obstetric Division of the Woman's Hospital, in the hope that these studies would reveal some helpful information. At that time analyses were made of the maternal deaths[1] and of the stillbirths.[2] These were based on the same 4000 consecutive ward deliveries, and covered a period of seven and one-half years (June 26, 1919, to January 1, 1927). The present work supplements these and is an analysis of the neonatal deaths occurring in the same 4000 consecutive deliveries to which have been added 2000 more deliveries making a total of 6000. This brings the study up to the present time and covers a period of about eleven years (June 26, 1919, to June 7, 1930).

In this series we have classified as neonatal deaths all cases in which the baby breathed after delivery, even though the respirations were feeble. Babies who were born with hearts which were beating, but who never breathed, have been considered stillbirths. Twenty-eight weeks of gestation have been accepted as the period of viability and any baby born alive before the twenty-eighth week, and subsequently dying, has been excluded. All deaths have occurred before the babies were discharged from the hospital, and with very few exceptions have occurred within the first two weeks following delivery. On this basis there have been 117 neonatal deaths among babies born to 110 mothers, or 17.83 per 1000 delivered mothers. Eleven of the deaths have been in twin pregnancies; in 5 cases both twins died, in 5 cases one twin died, and in 1 case one twin died and one was a stillbirth. There was one mother who had triplets, all of whom died. The length of time these babies lived has varied from five minutes to thirty-seven days. However, only 6 babies lived more than fourteen days. Fifty-one out of the 117, or 43.41 per cent, died during the first twelve hours after delivery.

The majority of these mothers, 91 of the 110, registered in the prenatal clinic, generally between the third and sixth months, and 19, or 17.27 per cent, were emergency cases; i.e., patients who came to the hospital for the first time, when in active labor or when suffering from

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some serious complication necessitating hospital care. There were in all 14 cases of toxemia; 9 among the prenatal cases, and 5 among the emergency cases, an increased incidence among the cases which were not attending the prenatal clinic.

Wassermann tests were made on 89 of the patients. Four had positive Wassermanns. None of the babies from the four plus mothers showed clinical signs of lues. In 2, however, the cord Wassermann was positive. In the other 2 the cord Wassermann was not taken. The 21 not having Wassermann tests occurred very early in the series.

Prematurity was a frequent complication in this series of neonatal deaths, there being 58 babies born before term. In 42 cases the cause of death was *directly attributed* to the prematurity. Fifty of the premature cases went into labor spontaneously and 8 were induced. Toxemia was associated with prematurity in 10 instances, syphilis in 1, premature separation of the placenta in 1, twins in 11 cases, triplets in 1, influenza in 2, placenta previa in 3, polyhydramnios in 2, congenital anomalies in 4, and pyelitis in 1 case.

TABLE I

28 to 30 weeks	14
30 to 32 weeks	18
32 to 34 weeks	13
34 to 36 weeks	8
36 to 38 weeks	5
38 to 40 weeks	59
	117

In this group of cases, contrary to our first impression, the number of babies delivered normally and abnormally was about equal. Fifty-five of the 117, or 47.18 per cent, were delivered without operative interference.

TABLE II

Normal	55
Forceps	
Low	16
Medium	8
High	3
Breech	16
Breech after version	15
Vaginal cesarean section	1
Cesarean section	3
	117

TABLE III

Normal	86
Flat	9
Justominor	6
Atypical (high promontory)	2
Not measured	7
	110

Pelvic deformity in the series of neonatal deaths, as in the series of stillbirths, was not an important factor. Eighty-six of the patients, or 76.36 per cent, had a normal pelvis, while 17 had an abnormal pelvis, and 7 were not measured. This is indicated in Table III.

Sixty-seven babies were autopsied and 50 were not. Among those autopsied, intracranial injuries were found in 25 babies; 7 of these were delivered normally, and 7 by a low forceps operation. Three were breech deliveries without version and 7 were breech deliveries following version. One was a high forceps delivery.

For the purpose of further study, these 67 autopsied cases have been analyzed in Table IV according to the chief cause of death found by the pathologist. Included in the same table for comparison are the 50 unautopsied cases, analyzed according to the chief cause of death determined clinically. It is instructive to note that 76 babies, or 64.94 per cent, died either from prematurity or from cerebral injury.

Of the 13 cases of asphyxia, 9 were not autopsied which gives rise to two questions: whether in all 9 this diagnosis was entirely correct and whether in some of these cases a cerebral injury may not have been associated with the asphyxia. In 3 of the 13, the baby died of suffocation while at breast; 1 of these was autopsied and 2 were not. As 5 out of the 6 cases of atelectasis were autopsied, it must be assumed that the figures for this condition are accurate.

TABLE IV

CAUSE OF DEATH	AUTOPSIED CASES	UNAUTOPSIED CASES	TOTAL
Prematurity	21	21	42
Cerebral injury	25	9	34
Asphyxia	4	9	13
Atelectasis	5	1	6
Bronchopneumonia	2	4	6
Congenital anomalies	5	2	7
Hemophilia	0	2	2
Impetigo	0	2	2
Lobar pneumonia	1	0	1
Icterus neonatorum	1	0	1
Spontaneous perforation of the intestine	1	0	1
Edema of brain	1	0	1
Hemorrhage in suprarenals	1	0	1
	67	50	117

The 7 congenital anomalies were all major defects: namely, extensive diaphragmatic hernia, spina bifida, malformation of heart, malformation of both kidneys, kink of intestines causing obstruction. The deaths of these babies as well as the 42 who died primarily from prematurity may with reason be classed as unavoidable deaths. If this is done, there remain 68 deaths for more extended analysis. These have been divided into two groups: the first, a medical group in which some condition arising postpartum was responsible; the second, an

obstetric group including those patients in whom the labor and the delivery were wholly or partially responsible for the deaths. In the first group are 22 cases, while in the second group there are 46. This is shown in Table V.

TABLE V

CAUSE OF DEATH	MEDICAL GROUP	OBSTETRIC GROUP
Cerebral injury	--	34
Asphyxia	3	10
Atelectasis	6	--
Bronchopneumonia	6	--
Hemophilia	2	--
Impetigo	2	--
Lobar pneumonia	1	--
Icterus neonatorum	1	--
Spontaneous perforation of intestine	1	--
Edema of brain	--	1
Hemorrhage in suprarenals	--	1
	22	46

In the medical group the 3 cases of asphyxia were caused by suffocation while nursing. In 2 of these cases it seemed purely accidental. In the third the question of intent arose and the case was made one for the coroner. On the ward service, even with the most careful nurse supervision, it is impossible to have a nurse with each patient throughout the entire nursing period and such accidents as these may from time to time occur.

Five of the 6 cases of atelectasis were autopsied and the diagnosis confirmed. Three of these were premature and 3 at full term. Seven babies died of pneumonia. Six had bronchopneumonia and one had lobar pneumonia. In 2 cases it was quite possibly contracted from the mothers, each of whom had an upper respiratory infection at the time of admission. Neither baby was allowed to nurse the mother until after the infection had apparently subsided. One baby nursed for the first time on the fourth day and the other nursed for the first time on the eighth day. During the eleven years this report covers, there have been three epidemics in the nursery due to an upper respiratory infection among the babies. Also during this time there have been two epidemics of impetigo; the deaths recorded were in the first epidemic. The origin of this infection was not discovered during either epidemic. The baby with perforation of the intestine was operated upon but did not survive the surgical procedure. The 2 deaths from hemophilia occurred early in the series, and by the present treatment with human blood serum or transfusion, we hope to prevent the occurrence of such deaths in the future.

In the obstetric group of 46 cases all the babies with the exception of the 10 who were asphyxiated died from some injury dependent upon either the labor or the delivery. In the 10 in whom asphyxia was given as the cause of death, the possibility exists that some of these

which were unautopsied may also have had a cerebral injury. In reviewing these cases it was found that 7 patients were delivered normally and did not warrant operative interference. There were 26 patients for whom operative interference was indicated; and we believe the interference elected was the one of choice for that particular patient even though a neonatal death occurred. This leaves 13 cases in which a neonatal death might possibly have been prevented. It is this group of deaths which we wish especially to emphasize.

The accompanying case reports give briefly the important items in each of these 13 cases. All these 13 patients except 2 had a normal pelvis. One of these had a simple flat pelvis and the other a high sacral promontory. Four cases were associated with a uterine inertia and these patients were permitted to continue in the second stage of labor for a long time. One patient ultimately delivered normally; a second (flat pelvis) was delivered by a moderately difficult low forceps, after a bag had been inserted and she had been given pituitrin; a third was delivered by a midforceps. The fourth patient had a bag introduced for dilatation of the cervix and after fifty-six hours was delivered by high forceps. In 3 cases there was very slow progress during the second stage and it was unusually long in spite of strong uterine contractions. Two of these patients were permitted to deliver normally and one was delivered by midforceps. There were 2 cases in which the head was arrested in a transverse position and 1 which remained a persistent occiput posterior. One of the patients with a transverse arrest failed to engage the head. She was permitted to continue in the second stage of labor for eight hours and ten minutes, with the infant's head floating, before a version was done. The second patient with a transverse arrest had a prolonged, dry labor of eighty-one hours. At the end of this time she was nearly fully dilated and there were signs of fetal distress. She was delivered by manual dilatation, manual rotation, and an easy high forceps. The patient with a persistent occiput posterior was allowed to continue with hard second stage contractions for seven and one-half hours before she was delivered by a Scanzoni rotation and easy high forceps. There was one case in which the cord prolapsed following the expulsion of a number five bag. Placenta previa occurred once in this group and the patient was bagged and later delivered by version. The remaining case, a patient with a premature baby, was delivered by forceps after a short second stage.

1. Primipara, thirty-nine weeks, normal pelvis. Prolonged second stage of labor, five and a half hours; slow advance, uterine inertia. After five hours the patient was given a small dose of pituitrin, and permitted to deliver normally. Baby weighed 5 pounds, 2 ounces. Condition at birth only fair. Died on sixth day, after many convulsive seizures and attacks of cyanosis. Autopsy: Cerebral hemorrhage.

2. Primipara, at term, normal pelvis. Prolonged second stage of labor three hours and ten minutes; very slow advancement, normal delivery. Baby weighed 8 pounds, 1 ounce. Condition at birth poor. Clinically: Signs of cerebral injury. Died in thirty-two hours. The baby also spit up a small amount of bright red blood and was considered a possible hemophiliac. It was given no treatment.

3. Multipara, at term, normal pelvis. Prolonged second stage of labor; three hours and five minutes of strong uterine contractions, associated with very slow advancement. Normal delivery. Baby weighed 8 pounds, 10 ounces. Condition at birth poor. Died on second day. Clinically: Cerebral hemorrhage.

4. Primipara, at term, normal pelvis. Prolonged second stage of hard labor, three hours. Head in low midpelvis. No advancement. Delivery: Low mid-forceps, when fetal heart began to fail. Cord once around the neck. Baby weighed 7 pounds, 1 ounce. Condition at birth poor. Lived one hour. No autopsy.

5. Primipara, at term, simple flat pelvis. Prolonged dry labor; uterine inertia. Bag for dilatation of cervix. Pituitrin 6 doses of 4 M. each at half-hour intervals to stimulate uterine contractions. Fully dilated with head in low midpelvis for three hours. At the end of this time there developed an hour-glass contraction of the uterus. Delivery: Moderately difficult low forceps. Baby weighed 9 pounds, 6½ ounces. Condition poor. Lived five and one-half hours. No autopsy.

6. Primipara, thirty-eight and a half weeks, normal pelvis. Prolonged first stage of labor; uterine inertia. Second stage five and one-half hours. Head in midpelvis. No advancement in spite of moderately strong uterine contractions, stimulated by ½ c.c. of pituitrin. Delivery: Easy midforceps after signs of fetal distress appeared. Baby weighed 5 pounds, 14 ounces. Condition poor. Died in six hours. No autopsy.

7. Multipara, at term, high promontory, transverse arrest. Normal first stage. Prolonged second stage of eight hours, head dipping, strong uterine contractions. Delivered by version. Difficulty with head at inlet. Baby weighed 7 pounds, 8 ounces. Condition at birth poor. Died in eighteen hours. Autopsy: Laceration of brain and cerebral hemorrhage.

8. Multipara, at term, normal pelvis. Wassermann, 3 plus. Prolonged dry labor eighty-one hours, uterine inertia. Head dipping, transverse arrest. After eighty-one hours almost fully dilated, signs of fetal distress. Dilatation completed manually, manual rotation, easy high forceps. Baby weighed 8 pounds, 3½ ounces. Condition poor. Died on sixth day. Autopsy: Congestion of all sinuses, vessels of cortex, and choroid plexus.

9. Primipara, at term, normal pelvis. Prolonged dry labor, bag for dilatation of cervix. Persistent occiput posterior. Second stage seven and one-half hours, strong uterine contractions without advancement. Failing fetal heart. Delivery: Scanzoni rotation and easy high forceps. Baby weighed 7 pounds, 6 ounces. Condition at birth poor; lived twenty-two hours. Clinically: A cerebral injury.

10. Primipara, at term, normal pelvis. Prolonged dry labor fifty-six hours, uterine inertia. Bag inserted for dilatation of cervix. After fifty-six hours patient was fully dilated, head only lightly engaged, L. O. A. position. Delivery: Difficult high forceps. Baby weighed 7 pounds, 6 ounces. Condition at birth poor; lived nine hours. Clinically: Asphyxia neonatorum.

11. Primipara, at term, normal pelvis. Prolonged first stage. Number 5 bag for dilatation of cervix. Prolapse of cord immediately following expulsion of bag. Patient delivered normally while being prepared for a version. Baby weighed 7 pounds, 14 ounces. Condition at birth poor, asphyxiated; died on third day. Autopsy: Multiple hemorrhages, large hematoma of suprarenals.

12. Multipara, at term, normal pelvis. Placenta previa covering two-thirds of the cervix. Number 3 bag inserted to control hemorrhage and to dilate the cervix. Bag expelled and cervix found to be four fingers dilated. Dilatation completed

manually, and patient delivered by version and breech extraction. Baby weighed 7 pounds, 4 ounces. Condition at birth poor. Lived one hour. Autopsy: Bilateral tear of tentorium with subsequent subdural hemorrhage. Large thymus.

13. Multipara, thirty-six weeks, normal pelvis. First stage of labor two hours and forty-five minutes. Second stage before interference only thirty minutes. At this time head on perineum and in R. O. P. position. Delivered by manual rotation and low forceps. Baby weighed 5 pounds, 7½ ounces. Condition good. Lived twenty-one hours. Autopsy: Rupture of right tentorium cerebelli with subdural hemorrhage.

In reviewing the above cases we cannot help being impressed with the fact that earlier intervention in each instance (except Cases 11, 12, and 13) was clearly indicated and would have given the baby better protection. In the first 3 cases an earlier delivery with forceps, instead of waiting for a spontaneous delivery would have been more conservative. In addition, the cause for bleeding in Case 2 should have been more carefully studied. If the baby proved to be a hemophiliac, it should have been given blood subcutaneously or even transfused if its condition did not improve. Likewise, earlier forceps delivery was indicated in Cases 4, 5, and 6. Case 7 is a borderline. Her past obstetric history is poor, and suggests trouble. This delivery was her first one at the Woman's Hospital. The high promontory could not be determined except under an ether examination. It is certain that no patient should be permitted to continue eight hours in second stage, especially with hard contractions and a floating head. In Case 8, one of prolonged, dry labor, associated with a transverse position, the use of a bag might have shortened the first stage of labor and allowed the mother and baby to reach the onset of the second stage without exhaustion. It would seem that Case 9, persistent occiput posterior, should not have been allowed seven and a half hours of second stage labor without any interference. Case 11 has been placed in this group because we believe that a No. 5 bag should never be used on account of its tendency to displace an engaged head, thus increasing the chance of the cord prolapsing. After the patient with placenta previa had had a bag introduced, she was delivered by version and breech. As this occurred recently, we believe that probably a cesarean section should have been the procedure of choice. Certainly cases of placenta previa are more easily handled by laparotomy and with less risk to both mother and baby. Case 13 was one of premature labor at thirty-six weeks, the baby weighing only 5 pounds, 7½ ounces. The patient a para ii after only thirty minutes of second stage, with the caput already in sight, was delivered by a manual rotation for an R. O. P. position and a low forceps operation. It would seem that this patient might have rotated this head spontaneously with less risk to the baby.

Constant prenatal supervision gives to each mother and baby the opportunity of reaching term in the best possible condition. The

obstetrician strives to insure to each unborn child the best possible chance for survival. This chance depends upon (a) careful watching of both mother and baby throughout labor, (b) due consideration in the choice of operation where interference is indicated, and (c) the providing of every protection in the nursery after birth.

SUMMARY

This study of the neonatal deaths in 6000 consecutive ward deliveries occurring on the obstetric service of the Woman's Hospital shows:

1. There were 117 neonatal deaths, 19.5 per 1000 deliveries. These occurred among babies born to 110 mothers.

2. There were 91 of these 110 patients, or 82.72 per cent, who had attended the prenatal clinic.

3. There were 58 premature babies among the 117 and in 42 prematurity was the chief cause of death.

4. There were 55 babies among the 117 delivered normally. Of the 62 delivered abnormally there were 27 by forceps, 16 by breech, 15 by breech after version, 1 by vaginal cesarean section and 3 by abdominal cesarean section.

5. There were 86 mothers among the 110 who had normal pelvic measurements.

6. There were 67 babies autopsied, and of these 25 showed cerebral injury.

7. There were 49 babies in which death seemed unavoidable; 7 with major congenital anomalies, and 42 in which prematurity was the chief cause of death. In the remaining 68 cases, 22 died from conditions occurring postnatal in the nursery, and 46 from conditions dependent partially or entirely upon the labor or delivery.

8. Among the 22 deaths from postnatal conditions, 9 were due to communicable diseases and three to accident.

9. Among the 46 deaths from intrapartum conditions, 7 were delivered normally; in 26 there were complications requiring an operative interference; but the elected method of delivery seemed to have been the best for each individual case and 13 analyses suggest that some of these deaths might have been avoided.

10. Among the 13 possibly avoidable deaths, there were 10 in which an earlier operative interference might have been employed, 1 where a too early interference was attempted, 1 where the use of a smaller bag would seem to have been wiser, and 1 where a cesarean section rather than a version and breech would be the method of election.

REFERENCES

Lyon, E. C., Jr.: Report of Scientific Work of Surgical Staff of Woman's Hospital 6: 192, 1925-1928. Lyon, E. C., Jr.: AM. J. OBST. & GYNEC. 14: 548, 1927.

121 EAST SIXTIETH STREET.

REPORT OF THE COMMITTEE OF THE OBSTETRICAL SOCIETY OF PHILADELPHIA UPON THE INCIDENCE AND TREATMENT OF THE TOXEMIA OF LATE PREGNANCY IN PHILADELPHIA*

By Edward A. Schumann, M.D., Philadelphia, Pa.

IN THE spring of 1928 the then president of the Philadelphia Obstetrical Society appointed a committee to investigate the incidence of late pregnancy toxemia occurring in the practices of the members of the Society, and to present a report upon this complication of pregnancy in Philadelphia. The members of this committee were Drs. Stuart Lawrance, Clifford B. Lull, John C. Hirst, and Edward A. Schumann (chairman).

The committee prepared a condensed history form, notified each member that such blanks were available and requested that data upon all cases encountered be returned to the committee. It was agreed to limit the time covered by the Survey to fifteen months, from July, 1928, to October, 1929.

Responses from the members were generous and enthusiastic, most of the larger clinics presenting full reports, the smaller hospitals and individual obstetricians contributing the remainder. It is interesting to note that one of the earliest to return a case history was one of our associate members living in far distant California; Dr. Harry S. Fist of Los Angeles. One hundred and eleven case histories were received in all and an analysis of the facts disclosed in these histories forms the subject of the report.

Only the condition loosely known as the toxemia of late pregnancy was studied, i.e., nephritic and preeclamptic toxemia and eclampsia itself. In a number of the returned histories, certain facts were not recorded, so that the analysis may be said not to be complete, but enough details have been gathered to present a fairly accurate picture of this symptom complex, its symptomatology, physical findings and management, to give a fairly comprehensive picture of the condition as it occurs in this city and is handled by obstetricians and practitioners here.

1. *Seasonal Incidence.*—It is commonly stated that eclampsia and toxemia of late pregnancy occur more frequently in the spring and fall. This statement being in a measure borne out in the present series of cases. The seasonal incidence was as follows:

January	6 cases		July	13 cases
February	5 cases		August	2 cases
March	0 cases		September	10 cases
April	7 cases		October	10 cases
May	12 cases		November	9 cases
June	17 cases		December	10 cases

The summer months will naturally show more cases because the time of this report extended through two summers, but this would not apply to the cases occurring in May and June or to those occurring in October and November. So that it may be said that in a general way there seems to be an increased frequency in toxemia of late pregnancy in the spring and fall. Among the severe cases and those having convulsions, the seasonal incidence was much the same. January, February and March showed none, April 4, May 1, June 3, July 1, August 1, September 3, October 2, November 1, December 3. Here the spring and the late autumn seem to provide the bulk of the serious cases.

2. *Age Incidence.*—The age in which toxemia occurs seems to have no bearing upon the condition, the greatest number of cases occurring at the age when the greatest number of women become pregnant. Thus in our series of patients the ages were as follows:

15-20 years,	15 cases
20-30 years,	47 cases
30-40 years,	36 cases
40 and over,	9 cases

It has been commonly said that these toxemias occur more frequently in unmarried women, but in the series under discussion 104 were married, 7 unmarried, so that the reverse would seem to be the case.

3. *Nativity.*—The nativity of the patients presented no conclusive evidences of a selective tendency, they being as follows:

U.S.A.	69	Jewish 5	
Italy	11	Irish 5,	Other foreign born, 10

4. *Parity.*—Of 105 cases in which the parity was recorded, 54 were primiparae and 51 were multiparae. These figures would indicate that primipare are more frequently affected, inasmuch as obviously there are many more multiparae than primiparae.

5. *Prenatal Care.*—Eighty-five had had prenatal care, 23 had had none, three were not recorded. Of these patients having prenatal care, most were admitted to hospital early upon the development of the toxemia, and treatment instituted before the disease was well under way. Of the five fatal cases, two had had prenatal care, three had had none.

6. *Previous History.*—Fifteen patients reported measles in childhood, 12 scarlet fever. Ten patients gave a history of nephritis being

present before pregnancy. Of the 51 multiparae, 11 reported a definite history of toxemia of pregnancy occurring in previous pregnancies, one woman having had severe toxemia with all 6 of her children, four of whom were living. Eleven per cent, then, of all cases gave a history of pregnancy nephritis and 20 per cent of the multiparous women had suffered toxemia with one or more previous pregnancies. In this series, therefore, it may be said that eclampsia tends to recur and also tends to follow a previous nephritis.

7. *Convulsions.*—Convulsions occurred in 28 patients:

1 in 5 patients	5 in 3 patients
2 in 5 patients	6 to 9 in 4 patients
3 in 4 patients	20 in 1 patient
4 in 2 patients	Not stated in 4 patients

The nature of the convulsions is not reported, but they occurred at term in 14 women, at eight months in 7, earlier in 4, and there were 2 cases of true puerperal eclampsia. All of the women who died had convulsions.

8. *Mortality.*—Of 111 cases, 6 patients died, a gross mortality of 5.4 per cent. It must be realized that many of these patients were not seriously ill, being admitted to hospital immediately upon the onset of the toxemia, so that one must not be too greatly encouraged by the apparently low death rate. Of the 28 women who suffered from convulsions or coma, 6 died, or 21.5 per cent, but among these were three patients admitted to hospital in coma and dying less than eight hours after admission. It would seem that these cases should properly be classified as too late for treatment and that the corrected mortality should be 3 deaths in 25 patients or 12 per cent. Of the six women who died, all of the babies died, three being undelivered.

9. *Classification of Cases and History of Present Illness:*

14 cases were classified as mild
64 cases were classified as severe
28 cases were classified as eclampsia

The symptoms were those usually ascribed to the toxemia of late pregnancy, headache, generally described as severe, being present in the great majority. Nausea and vomiting were common, sharp increase of weight was noted in many charts and blurred vision, indigestion, epigastric pain, and edema completed the syndrome.

The physical examination of the patient upon admission was not well recorded on most of the histories. No thyroid alterations were remarked, 48 women were classified as having general edema and 10 slight edema. Jaundice was uncommon, it being noted in but one patient and as slight in this single instance. Heart and Pulse Rate: The pulse rate is very significant as a prognostic index as shown in

our series of cases. In 59 the rate was below 90, 20 the rate was between 90 and 110, 19 the rate was 120 and over. All of the patients with pulse rates over 120 were severely ill, the fatal cases coming into this group. Five women were noted as having heart murmurs, none of these being in the fatal group. The pulse rate in eclampsia is a most important prognostic indicator, pulse rates of 100 and over being usually associated with the more grave manifestations of the disease. Four patients had edema of the lungs, two of these died. In five patients moist râles were described, but of all those women recorded, the eye grounds were affected in 14, retinitis being present in 7 and hemorrhage and edema in 7. Pyelitis was present in 3 patients.

10. *Blood Pressure Findings.*—One hundred and seven of the 111 reports present enough data to warrant recording. For the purpose of comparison and discussion the 107 cases have been arranged according to their apparent severity into 3 stages, mild, severe, and eclamptic. The cases in each stage have been subdivided, when possible, into 3 groups, i.e., those in which:

    a) Symptoms or physical signs appeared, after a rise in blood pressure.
    b) Symptoms or physical signs appeared, before a rise in blood pressure.
    c) Symptoms or physical signs appeared, but there was no rise in blood pressure.

It is proposed to first discuss those determinations which were the most frequently and the most correctly reported.

Increase in blood pressure was the most common feature noted in the clinical histories of this series. The systolic pressure was above 200 mm. in 23 cases, between 180 and 200 in 28 patients, 150 and 180 in 43, and 120 or below in but 4. Among those women who vouchsafed a history of previous nephritis, the blood pressure was universally high, all of them being above 200 mm. systolic.

There was a rise in blood pressure in all of the 14 mild cases; but in 8 of these the rise appeared after or with the appearance of symptoms or physical signs and only 6 times before them. There was a rise in blood pressure in 57 of the 64 severe cases; but in 45 of these the rise appeared after or with the advent of signs or symptoms, and only 12 times before. In 7 there was no rise among the 64 cases. There was a rise of blood pressure in 27 of the 28 reported eclampsias, and apparently no rise in two of them. It may be deduced from this analysis that exclusive dependence on a rise in blood pressure to give one the first warning of toxemia, is not wise. It appears to fail to do so in over one-half of the mild, three-fourths of the severe, and while the data reported concerning the eclampsias are not sufficient to warrant a statement of fact, yet it would seem to be true for this stage also.

The values of the pulse pressure were lower in the mild than in the severe or eclamptic stages.

11. *Kidney.*—Albuminuria of course was the common finding. Eight patients had no albumin, 15 a trace or faint trace, while in the remaining 88 the records show heavy clouds. Tube casts were found in varying amount in 96, while 15 urines were negative for them. The casts were mainly granular, many hyaline and few blood casts.

The determinations related to renal chemistry, pathology, function, and bacteriology were more adequately reported than any other determinations except those of blood pressure.

Relation of Fluid Intake to Output.—Output was less than half of the intake: in 1 of 2 reported mild stage determinations; in 8 of 16 severe stage reported determinations; in 4 of 14 reported eclamptic determinations. Nevertheless, the output was over one-half the intake in a surprisingly large number of cases. Five cases were reported without any determination. In the reported cases both the incidence and the amount of albumin and casts increase from the mild to the severe stage. Of the 102 reported for albumin, 6 were negative. There was a lack of reports concerning glucosuria, acetone, diacetic acid, urobilin and indican, which is probably due to the dependence evidently placed on blood pressure rise to give a first warning.

Renal Function.—In summary the results may be put as follows:

In the first hour less than 38 per cent was excreted in:
 3 of 4 mild stage cases reported
26 of 36 severe stage cases reported
 4 of 6 eclamptic cases
In the second hour less than 22 per cent was excreted in:
 0 of 4 mild stage cases reported
17 of 36 severe stage cases reported
 2 of 6 eclamptic stage cases reported

Renal Bacteriology.—In the whole series but 32 determinations were made; of which 23 were negative, 6 reported B. coli, 2 the B. pyocyaneus, and 1 the Staphylococcus aureus.

12. *Blood Chemistry.*—The investigation of metabolism as expressed in terms of blood chemistry was not only woefully neglected but carelessly reported. Certain observations should accompany every blood chemistry value reported; otherwise the value will seldom be of either practical or theoretic worth. The observations required are:

1. Method of analysis.
2. Date of taking blood.
3. Time of taking blood.
4. Relation of the given date and time to (a) food intake, (b) glucose intake, (c) medication, (d) fluid intake, (e) convulsion, and (f) sleep.

In only 4 of the reported determinations was any effort made to supply any of this information. As most of these observations are necessary to establish the true meaning of most of the determinations, and

as the problems of carbohydrate, proteid and probably of fat metabolism are of the crucial questions of toxemia, it is earnestly urged that all Chiefs of Service:

1. Employ this method for diagnosis and prognosis regularly and consistently.

2. Lay down rules concerning the observations to be noted at the moment each specimen of blood is taken and that the specimen be so identified with these observations that the subsequent readings can be properly interpreted. A chart such as Titus has devised for blood-sugar interpretation can be easily prepared carried out or adapted to other blood chemistry readings.

Blood Sugar.—For all practical purposes the determinations reported are without value except in 3 cases. Taking the values as they stand, without knowledge of methods of analysis, time or relation, it may be cautiously said that a hyperglycemia is apparently more frequently reported than a hypoglycemia. It is obvious that such a statement is not decisive and no decisive statement can be drawn from the figures as given. However, if the various services will unite in a more standardized method of employing blood-sugar determinations, as well in the clinic as in the house, and if the readings are correlated with the required observations, much information of value would accumulate and a great deal of help in diagnosis and prognosis would be afforded the clinics. *Nonprotein nitrogen* was reported seldom except in eclampsia. As these stand, 12 of the 14 were between 30 and 40. *Urea.* As these estimations stand, of the 27 made in eclampsia, 24 were between 16 and 30. *Creatinine* was reported more generally throughout the 3 stages. The values as they stand show a steady increase from the mild to the eclamptic stage. In the mild stage none of the readings are above 1.5. In the severe stage 5 in 17 were above 2.0. In the eclamptic stage 5 in 18 were above 2.0. One in the severe and 4 in eclampsia were between 3.5 and 5.2. *Uric Acid.* Ten reports only.

CO_2	40-50	51-60
Mild stage	3 of 3 reported	0 of 3 reported
Severe stage	8 of 13 reported	5 of 13 reported
Eclamptic	3 of 6 reported	3 of 6 reported

Van den Burgh Test.—There were reported 22 severe and 10 eclamptic determinations, of which 2 were positive, 2 gave immediate direct reaction, and 2 delayed indirect reaction. Wassermann plus 4 once in the whole series, all but 43 reporting.

Blood Counts.—Very few references to date and time, but a large number of reports, which making allowance for the increase of red cells said to be associated with pregnancy and for the increase of white cells in late pregnancy and early puerperium, seem to indicate that there is a moderate anemia in toxemia and a slight increase in the usual leucocytosis.

13. *Duration of Pregnancy.*—The earliest noted appearance of toxemia was in one patient at the fourth month, this woman had 6 living children, one termination of pregnancy with twins for high blood pressure, disturbances of vision, etc. She was admitted during the fourth month with a blood pressure of 242/140 and continual headache. She was treated by elimination, followed by hysterectomy under local anesthesia, leaving the hospital in good condition. In 6 patients the symptoms of toxemia appeared at the sixth month, in 60 at term and the remainder being scattered through the last two months of pregnancy. Only two cases are recorded of true puerperal eclampsia. Hydamnios was noted in 6 cases, oligohydramnios in one. Two patients had slight bleeding during pregnancy but in the entire 111 there was but one case of abruptio placenta, a somewhat significant fact.

Position and Presentation.—In the entire series there were but three breech presentations, the remainder being vertex and there were two pair of twins. Fetal heart sounds were noted as being present in 41, absent in 14, not recorded in 26.

Treatment.—A survey of the treatment afforded the women in our series of cases disclosed a striking unanimity of opinion among Philadelphia obstetricians as to the management of the toxemias of late pregnancy. In the mild cases elimination by means of colonic irrigation with large quantities of water, sweat baths, with purgation by magnesium sulphate. In the more severe cases the elimination treatment was continued with the addition of morphine with or without chloral, many of the reports using the term: "Stroganoff" or "modified Stroganoff." The intravenous use of glucose in 25 per cent solution was very general, a majority of the patients receiving this. A much smaller number were treated with magnesium sulphate intravenously in addition to sedation and elimination. Fifteen patients were treated with heparmone, but as the series has previously been reported by Dr. J. C. Hirst, the details will not be further considered in this survey. Venesection was employed in 7 patients, their systolic blood pressure being respectively 180, 180, 170, 176, 168, 220, 200 mm. The employment of inhalation anesthesia for the control of convulsions is not reported in a single case.

After elimination and sedative treatment had been employed for various lengths of time, most of the obstetricians induced labor either by medical means (few) or by bougies and followed this in many instances for forceps extraction or version. There were no instances of accouchement forcé. Twenty patients were delivered by forceps, 3 by version. Three women died undelivered.

There were 67 spontaneous deliveries. There were 11 cesarean sections, 9 classical, 2 cervical, the indication being fibroma uteri 1, increasing toxemia without effacement of cervix 7, contracted pelvis 2,

abruptio placenta 1. None of the mothers died, 3 infants were still-born, 1 died shortly after birth, a cesarean mortality of 0 mothers and 40 per cent babies.

End-Result.—It has been stated that 6 mothers died, a mortality of 5.4 per cent of the remaining 105, 25 are noted as showing albumin in the urine after discharge from the hospital, while 10 retained systolic blood pressure of 130 or over upon delivery.

Sixty-seven babies were alive and well, 31 were dead, and the fate of 13 is not recorded, some of them being undelivered when the patient left the hospital, not yet at term. The fetal mortality being 31.6 per cent.

CONCLUSIONS

In the year 1928, 49 women, and in 1929, 36 women in Philadelphia died of the various toxemias of pregnancy as listed under International Causes of Death, 148. This survey lists 6 deaths in 29 eclampsias alone, 14 of whom received prenatal care. Considering these facts, and likewise that the cause of toxemia is unknown, and finally considering the state of the data of laboratory investigations just summarized, it may be suspected that the prenatal clinics are not functioning as efficiently as they should. It is recommended that:

1. The Chiefs of Obstetric Services exercise definite supervision and that they attend personally and frequently the prenatal clinics of their departments, so that:

a. The clinics will profit by their knowledge and be inspired by their interest.

b. Inefficient officers and nurses may be recognized early.

c. The necessary routine will not degenerate into a mechanical and routine performance.

2. Exclusive dependence on a rise in blood pressure to indicate the first evidence of toxemia be avoided.

3. That more regular and more intelligent use of blood chemistry and other metabolic determinations as well as more complete uranalyses be employed in the clinic.

4. History of preexisting nephritis, or toxemia in previous pregnancies should place the medical attendant upon his guard, since all cases in this series, presenting such histories, developed severe toxemia.

5. Treatment of late pregnancy toxemia has become fairly standardized in Philadelphia, the general rule being elimination, followed by a modified Stroganoff procedure should evidence of nervous irritability develop, and further followed by induction of labor and surgical delivery in the event of failure on the part of the patient to improve. Inhalation anesthesia to combat convulsions is no longer recognized as a part of the therapeusis of eclampsia. The use of glucose is routine in many clinics. In 11 patients subjected to cesarean section, there was no maternal mortality, an excellent record.

6. The total mortality of 5.4 per cent is well on the low side in the management of this complication of pregnancy. A mortality of 21.5 per cent of all women having convulsions or coma and a corrected mortality of 12 per cent of patients coming under observation only when moribund be excluded, is well within the limits of good treatment. The fetal mortality remains enormous, 31.6 per cent. In the light of our present knowledge this death rate cannot be greatly reduced and it would seem that the efforts of obstetricians should be directed toward means of preserving more of these infant lives.

7. Patients recovering from preeclamptic and eclamptic toxemia, in general were discharged in good condition with but slight evidences of permanent kidney or cardiovascular damage. True, nephritis toxemia left the patient with permanently damaged kidneys.

Finally the committee begs to thank the members of the Philadelphia Obstetrical Society for their support and interest in this survey and to suggest that with further experience in conducting such studies, both on the part of future committees of investigation and of the contributors of case reports, much valuable data may be secured upon other obstetric as well as gynecologic problems by this new plan of study.

Cullen, Thomas S.: The Training of the Gynecologist. Brit. M. J. 2: 941, 1929.

Every gynecologist should have a fundamental knowledge of medicine; he should be an abdominal surgeon and have a thorough grounding in general pathology as well as in the pathology of the particular branch which is to become his life work.

The method of training gynecologists at Johns Hopkins Hospital is as follows: Every year five of the graduating class are assigned to the gynecologic department. These men take histories, assist at operations, and work in the gynecologic and cystoscopic dispensaries. At the end of the year four of the men drop out, the fifth remaining with the department. The man thus promoted spends his second year in the study of general pathology. The third year he again returns to his specialty. He now describes all gynecologic material, supervises the cutting and staining of sections, and gives a detailed description of the histologic findings. He is also expected to work on special gynecologic problems. In his fourth year he is first assistant at operations, has general supervision of the wards and when the resident is away is in charge. In his final and fifth year he has full charge of the department, and in addition to assisting the visiting surgeons he performs many major and minor operations himself.

G. E. HUDSON.

THE TEACHING OF OBSTETRICS AND MATERNAL MORTALITY*

By Palmer Findley, M.D., Omaha, Neb.

WE HAVE reached the first milestone of a new organization, an organization devoted to the interest of obstetrics and gynecology. We who have been concerned with the inception of this Association of Obstetricians and Gynecologists of the Central States were heartened beyond measure by the response to our call to a preliminary meeting in St. Louis a year ago. More than 200 responded. The program presented by the St. Louis group was of the highest excellence and the demand for a permanent organization was spontaneous and enthusiastic.

I count it a rare privilege and a signal honor to be your first presiding officer and if this organization is to continue to function as it gives promise of doing, the group of men who constituted themselves as the committee on organization will have made a real and enduring contribution to the advancement of American Obstetrics and Gynecology.

It was truly an unselfish move on the part of these men, for they all personally felt surfeited with society affiliations. It was solely in the interest of our specialty and of men in the Central States who are earnestly endeavoring to perfect themselves in the art and science of obstetrics and gynecology that this Association was conceived. If obstetrics and gynecology are to keep step with the advance of medicine and surgery there must be opportunity for inspiration and self-expression among the men who are devoting their lives to the specialty. Here in the midwest such opportunities have been lacking. Local, district, and state medical societies have failed to give any considerable recognition to obstetrics and gynecology; our medical periodicals are limited in their scope and hence these men find it difficult to obtain space for their contributions. All this tends inevitably to retardation in development. It is to be hoped that this organization will supply a medium for self-expression and a source of inspiration for every man who is earnestly endeavoring to perfect himself in the science and practice of obstetrics and gynecology. Those who constitute the charter membership of this group were selected because of their position of leadership in their respective localities—they are men who will be enriched by such contacts and will in turn reflect benefit upon the communities in which they live.

This association has wisely associated gynecology with obstetrics. Throughout the Continent and to the north and south of us the two are almost uniformly combined in teaching institutions and in practice. Here in the United States we find fully 80 per cent of all Deans of Medical Schools favor the combined chairs. Gynecology cannot and should not stand alone. Obstetric problems are not solved until the mother is restored to a perfect physical state, no matter what the time limit may be. There can be no line of demarcation between an obstetric and a gynecologic service—it is folly to make such a distinction. More than half of gynecology is the by-product of poor obstetrics, it represents in large part the morbidity of obstetrics and to a very large degree is chargeable to lack of proper prenatal and postnatal supervision.

In the Bulletin of the American Medical Association, June, 1930, we have the report of the Council on the resolution adopted at the Portland meeting requesting an investigation of the teaching of obstetrics in the United States and further requesting that "the Council make such recommendations for increasing the clinical teaching hours as might be warranted by the results of its investigations." In the report of the Council we are advised that the teaching of obstetrics has been tremendously improved since 1905—this opinion being based upon the following data:

1. Announcements of medical schools show that all medical schools offering four years of instruction have regular staffs for the teaching of obstetrics.

2. The time devoted to the teaching of obstetrics on the average compares favorably with the time devoted to the teaching of surgery.

3. In the "model curriculum," formulated in 1909 by the Committee of One Hundred, acting under the auspices of the Council on Medical Education, 650 hours was assigned to obstetrics as compared with 680 hours for surgery.

4. In the several complete tours of inspection of all medical schools, their rating in class A, B, or C depended, among other things, on the provision made by each school for instruction in obstetrics by means of (a) lectures or recitations, (b) the examination of patients in prenatal clinics, (c) the witnessing of the delivery of patients in demonstration clinics, and (d) the provision of opportunities of students to deliver maternity patients personally under supervision.

5. Not only have the Council's requirements been well met in the medical schools, but increasing numbers of maternity patients have become available whereby the recent graduates have been enabled to care personally for larger numbers of patients.

6. Even with the great improvements secured since 1900, efforts for further improvement have not been relaxed. In the Council's recent conference, for example, a special symposium on the teaching of obstetrics was arranged, in furtherance of Dr. Bloss's resolution.

From my personal correspondence with the heads of a number of obstetric departments, I am privileged to quote their comments on the above resolutions:

Dr. Jennings Litzenberg of the University of Minnesota responds as follows: "1. Of course all medical schools, offering four years of instruction, have a regular staff for teaching obstetrics, but the question is, how well trained are these staffs? Are they composed of men who have taken an extensive training in obstetrics, and how much time do they give to teaching? Also, how much of the staff is full time?

"2. I am doubtful if the second statement is correct. I am of the impression that if the investigation of the actual teaching of obstetrics would be carried on in the same manner as you did in other countries, some glaring discrepancies might be found between the teaching of surgery and obstetrics.

"3. If 650 hours are devoted to the teaching of obstetrics as compared to 680 hours for surgery, according to the curriculum, this would be quite satisfactory. The question is, would an investigation, such as I have suggested above, substantiate these hours? (I do not believe there is a school in the country that is devoting 650 hours to teaching obstetrics.)

"4. Did the committee, in this investigation of all medical schools, investigate the clinical teaching and the amount of clinical material available for such teaching? Was the teaching usually lectures and recitations, or were there large numbers of women to permit proper clinical teaching and for the students to deliver under proper supervision?

"5. I doubt that an investigation as thorough as the one you made, would substantiate the fifth statement that the council's requirements were being well met by the medical schools and that the recent graduates have been able to care for a large number of patients.

"6. The council's recent conference, in the symposium on the teaching of obstetrics, revealed that every speaker felt that the material and time for clinical teaching of obstetrics was entirely inadequate.

"Personally, I am convinced that in all probability the number of so-called didactic hours given to obstetrics are quite adequate in most schools. There are in nearly all schools at least enough hours given for lectures, recitations, etc., but I doubt if the material available, for the teaching of students in clinical hours, is adequate. The report to me sounds entirely unconvincing and from my small knowledge of the teaching of some schools throughout the country, I do not feel that the subject of obstetrics is adequately taught clinically."

Dr. Fred L. Adair of the University of Chicago observes that:

"With reference to number 1, it is undoubtedly accurate that all medical schools offering a four-year course have a regular staff for the teaching of obstetrics.

"I am skeptical about the accuracy of number 2, and doubt very much if the time devoted to the teaching of obstetrics compares favorably to the time devoted to the teaching of general surgery.

"With reference to number 3, I believe we could find no basis for objection to the assignment of practically an equal number of hours to obstetrics and surgery, but my impression is that most schools are not living up to this 'model curriculum.'

"In regard to number 4, I believe the four criteria for rating schools, so far as obstetric instruction is concerned, are all good. I believe, however, there should be added to these, (e) manikin course, and (f) postnatal clinics.

"With reference to number 5, I think it is undoubtedly correct that medical schools have made improvement in their obstetric teaching and that the number of maternity patients available for observation is increasing. The provision is, however, still inadequate for the adequate preparation of the students for the practice of obstetrics.

"Number 6 is very commendable, and I am pleased to know that a great deal of attention is being given by the Council on Medical Education to the teaching

of obstetrics. There is no doubt that the teaching of obstetrics has greatly improved in the last twenty years.

"It is probably true that much of the obstetrics which students see is either pathologic or operative. What the students really need for ordinary practice is ability to conduct the usual obstetric cases and to recognize pathologic conditions rather than an opportunity to observe and learn major obstetric procedures, which should in so far as possible be reserved for institutions and placed in the hands of especially trained men."

Rudolph Holmes, of Northwestern University, expresses the conviction that "the didactic teaching may be ever so strong, but the contact with patients in a truly organized pre- and postnatal clinic and maternity are lacking in almost every center. As a result most men graduate with a very scant knowledge of clinical obstetrics." Holmes is of the impression that "obstetrics is not taught as comprehensively as are medicine and surgery" and expresses the hope that the White House Conference will aid in solving the problem. "In the meanwhile," he adds, "there is something wrong in our teaching of obstetrics."

Dr. Frank Lynch of the University of California writes that "Since the Council of Medical Colleges has clearly shown that they have not yet accepted our problem, I feel the matter is up to the state boards. Thus far every state board in the country has kept step with the medical schools, modifying their licensing examinations so that they may correspond to the courses given in medical colleges, yet they do not realize that when one is licensed by a state examining body, they are turned loose to do anything that they feel like attempting in their practice. For many years I have felt that the public will not be properly protected until a practitioner is licensed to practice in definitely specified subdivisions in medicine. Thus one might take an examination which would license him to practice as a general medical man without doing surgery or obstetrics without showing any more evidence of apprentice training than would be obtained in his degree from the medical school. On the contrary, I believe that no state board should confer the right to practice obstetrics or surgery to anyone who has not had a proper apprenticeship. In obstetrics, I believe this means an apprenticeship which would give the student an opportunity of attending a minimum of 100 women in confinement together with proper prenatal and postnatal care.

"This conclusion has been forced on me since in a review of our work we find that our incidence of midforceps or high forceps is one to 34 cases, that is, if the student is to see anything more than low forceps or breech extractions, he must plan for at least 50 cases. There is no doubt whatsoever but that a student who has seen only low forceps and who attempts the extraction of an occiput posterior in transverse arrest and fails, the next time will turn to cesarean section which, unless he has had an apprentice training, he should not undertake. There is nothing new in this observation nor in our thought that an apprentice training is necessary. The fact that it has safeguarded the public in the countries in which it is attempted is well evidenced by the obstetric situation in the Scandinavian countries."

Dr. A. M. Mendenhall of the University of Indiana gives the encouraging report that the department of obstetrics in Indiana has been given practically double time for teaching. "I am," he writes, "much enthused over the bloc system which I have adopted here and a copy of which I sent you a few weeks ago. Every twelve students have six weeks during which time the whole time is given to obstetrics. We have gotten this into the curriculum in addition to the regular lectures, recitations, quizzes and clinics. This is a step forward, but we need a few more steps. More time should be allotted to obstetrics than to surgery. A beginner in practice does much more obstetrics than he does surgery. He should be thoroughly taught those things which he is most likely to be called upon to do,

and which can be easily shown to be general medicine, obstetrics and a small amount of minor surgery. I agree with this but would add that a very careful supervision home delivery service by a student is advantageous but if he is merely allowed to act as a stork and is not followed up by competent teaching, it is poor obstetric pedagogy.''

The only criticism offered by Dr. Barton Hirst of the University of Pennsylvania is with reference to the use of hours assigned to instruction in obstetrics. He much prefers the European system of blocks of time.

Dr. Joseph DeLee of the University of Chicago is of the opinion that ''while theoretical instruction may be enough—practical work on patients and research are both as yet deficient.''

Dr. Percy W. Toombs of the University of Tennessee writes: ''I am importuned daily to teach my students operative obstetrics. I believe students should be taught normal obstetrics during their collegiate course and given only the most essential of emergencies in obstetric practice. I believe operative obstetrics should be given in a postgraduate course just as the refined technic of the various specialties in general surgery are now given.

''Does the general practitioner of medicine enter the special field of eye, ear, nose and throat or that of specialized abdominal surgery without special preparation? If he does not why should he be allowed the privilege of bartering human life at its very beginning without preparation?

''Until provision is made in the curricula of medical schools for such preparation the present distressing high rate of mortality will continue. If there is to be any reduction in maternal mortality there must be a more widespread knowledge and clearer understanding of the importance of the principles underlying proper obstetric care.

''With proper supervision of the pregnant woman the lives of many mothers would be saved who are otherwise sacrificed upon the altar of maternity.''

Dr. L. A. Calkins of the University of Kansas writes: ''It seems to me that the statement of the Council in the Bulletin of June, 1930, is quite inadequate and does not give the matter anything like its due consideration. Inasmuch as the obstetrics of the future is going to be more and more in hospitals, it seems to me that medical students should have considerable more obstetric training as it is done in hospital practice. It is very much easier to provide adequate instruction from the hospital cases than it is for outside deliveries. We are also badly in need of opportunities for postgraduate instruction in this country.''

Dr. E. D. Plass of the University of Iowa finds the report of the Council so general that he fails to see any value in it. To provide more adequate clinical facilities Plass would have our schools affiliated with maternity hospitals—to do this ''artificial barriers must be broken down or extended.'' With less- than a delivery a day, Plass finds that he is lacking in clinical material for the instruction of his students.

''I agree with you,'' writes Dr. Jeff Miller of Tulane University, ''that in spite of the improvement, there should be no relaxation in the efforts of the various organizations to continue the improvement, for there is still room for it. Any specialist who sees complicated and badly managed cases knows that, and any man who has had, as I had for many years, a service in a public hospital devoted to that sort of case, wonders if things are really any better. A ward of that variety gives much food for thought. Certainly there is no subject in which the young physician so much needs training, for he still gets a large part of his practice in the first years from maternity cases, and he is still too much inclined to treat them as all in the day's work rather than as conditions which need his best efforts and which may in a moment develop complications of the utmost gravity. On the other hand, I think we should emphasize without ceasing the fact

that the majority of labors are not pathologic but physiologic, and that it is the first task of the physician to keep them normal.''

Dr. Franklin S. Newell of Harvard University writes as follows:

''The copy of the report of the Council of the A. M. A. on the teaching of obstetrics seems to me to say very little. My own impression is that since obstetrics came to be considered a specialty, even though it is recognized as one of the fundamental clinical subjects, more and more time is devoted to surgery and less and less to the teaching of obstetrics. I will admit that we have much more chance for clinical teaching than we used to. We have in the third year ten days to two weeks devoted to district work where the men do nothing else, and we have four weeks in the fourth year where the men give their full time to obstetrics. On the other hand, we have only thirty-six hours for lectures and demonstrations where we had ninety-six hours when I was a student. I do not believe that the theory of normal obstetrics and the complications can be properly demonstrated to a class in thirty-six hours, and I think that the theory should be driven home very thoroughly in the second and third years so that the men can appreciate their clinical work.

''All of our clinical departments have had their didactic teaching hours cut in the last two years so that more time could be devoted to clinical work in the hospital. All of these hours which have been saved by cutting down the number of lectures, demonstrations and recitations have been added to the clinical teaching of medicine and surgery, and none of it has gone to obstetrics. Perhaps we have been better organized than the other departments or at least organized at an earlier date and we may not need the increase in time as much as they do, but in the last few years we have been definitely cut for the benefit of the other departments.''

Dr. Sproat Heaney of Rush Medical College, Chicago, expresses surprise at the report of the Council on Medical Education and says:

''I have no doubt at all that obstetrics is well taught didactically in all medical schools. The great difficulty in America, however, is the deficiency in clinical teaching and the paucity of clinical beds for obstetrics. Internal medicine and surgery almost everywhere have sufficient beds for the thorough teaching of clinical medicine and clinical surgery. Hardly anywhere are there enough beds to teach obstetrics as it should be taught. The clinical teaching of obstetrics is relegated to the Out-Patient Department and when objection is made to this the non-obstetricians say, 'Obstetrics should be taught in the home because most mothers are delivered in their homes.' Delivery in the home is not objectionable except that the teaching is done by the externe while the professor of obstetrics and the well-trained instructors in consequence have little to do with the clinical teaching of their branch. Why should surgery and medicine be properly taught by experts while the clinical teaching of obstetrics is delivered over to the most ignorant members of the obstetric staff?

''Furthermore, obstetrics should have more than its normal 'proportion of clinical beds.' Every medical case and every surgical case is per se pathologic and abnormal while the obstetric cases are mostly normal and it requires so many cases before the student meets an abnormal case.''

Dr. John Polak of the Long Island College and Hospital expresses dissatisfaction with the report of the Council in that it has failed to meet the issue squarely. He is of the impression that in 60 of the 78 medical schools in the United States, prenatal clinics are lacking or of doubtful character and adds: ''There is no question that there is and has been great improvement in the teaching of obstetrics since 1900, but the whole thing is so poorly arranged and so belittled that the students do not get the impression that obstetrics includes a knowledge of medicine, pathology, physiology, biochemistry, serology as well as surgery. If

every school would adopt the plan of instruction mapped out at the Chicago Conference the whole plane of obstetric teaching would be elevated.''

Dr. Brooke Bland of Jefferson Medical College, Philadelphia, has developed within a period of five years one of the best departments of obstetrics in the country. He has the following to say:

''In Jefferson something more than 200 hours are devoted to instruction in obstetrics and gynecology. This does not include the work done in the Out-Patient Service, the time spent in witnessing ten to twenty deliveries in a Lying-In Hospital, covering a period of one week, nor witnessing deliveries in their senior year, in our Maternity. I believe that the statement made is somewhat in error. I do not believe there is any medical school in the United States that devotes 650 hours to the teaching of obstetrics and gynecology, nor do I believe it is necessary to set apart that much time for the consideration of the subject. I do not believe it possible to devote 650 hours to the study of obstetrics in a college curriculum. I cannot conceive how it would be possible to arouse interest in the student and make so long a time attractive.

''I find that all the suggestions submitted are followed in my Department at Jefferson, except the provision of opportunities for students to deliver maternity patients personally. I do not think this is a wise course. I would hesitate to adopt it in my department. I believe that more harm than good, especially for the patient, would follow the procedure. An obstetrician cannot be made in the classroom, regardless of the number of hours devoted to obstetric instruction. I would go further and say that entirely too much time is devoted to the teaching of major surgery and certainly some phases of the subject that nine students out of ten will never have occasion to practice.

''Unquestionably the facilities for teaching obstetrics have been enlarged tremendously during the past few years and I am quite convinced that the men graduating today are better prepared than any time in the history of obstetrics, in our country.''

We appreciate the interest the Council has manifested in our problem, but we frankly dissent from some of their deductions. We grant that there has been much improvement in the teaching of obstetrics since 1905 but the progress made has not been commensurate with that made in the teaching of medicine and surgery in the same period of time. There is evidence on every hand that obstetrics is receiving more favorable consideration at the hands of our teaching institutions. Larger clinical facilities are being provided and more and more stress is placed on clinical instruction in obstetrics. But the teaching of obstetrics in our medical schools has lagged far behind that of surgery and medicine and even that of some of the minor subjects. Once the governing board of our teaching institutions become cognizant of the axiom that it is the business of our undergraduate medical schools to prepare their students for the general practice of medicine, there is little difficulty in bringing about a more generous consideration of the need for more and better clinical instruction in obstetrics.

It is gratifying to learn from the report of the Council that the announcements of medical schools offering four years of instruction reveal that all have regular staffs for the teaching of obstetrics. It had not occurred to us that the announcements of our schools would fail

to list a teaching faculty in obstetrics—such an omission would be needless economy in space and printer's ink.

The statement that the time devoted to the teaching of obstetrics compares favorably to the time allotted to the teaching of surgery is a finding of the Committee of the Council that is misleading. A few years ago the ratio of teaching hours in surgery as compared with obstetrics was as 4.5 is to 1. It is now about as 2 is to 1—this is progress. Furthermore, it is contended that it is not a matter of numbers of teaching hours but rather of how the teaching hours are employed. It is our contention that as compared with surgery the teaching of clinical obstetrics is woefully lacking in the major portion of our medical schools. Not less teaching of theory but more clinical teaching is the need of obstetrics.

We do not need to look to our less favored institutions alone for verification of our contention. There are schools in the United States of the highest order where clinical surgery is provided for in overabundance and where clinical obstetrics receives scant recognition. A recent visit to one of our foremost teaching institutions revealed a magnificent hospital of a thousand beds, with space and equipment for the clinical teaching of surgery that is unexcelled, while obstetrics is relegated to an antiquated outbuilding where students do not have sufficient material at their disposal to provide sufficient cases for even a portion of the student body. Here there are eight admissions to the surgical department to one to the obstetric department. Excellent didactic instruction is given by a faculty of the highest order but the lack of clinical material falls far short of the minimum requirements. And this in an institution that has four times the number of clinical beds required for teaching purposes.

I refer to this institution as a striking illustration of the inadequacy of clinical teaching in obstetrics and such examples are not exceptional. It is difficult to understand how in "the several complete tours of inspection of all medical schools" the lack of prenatal instruction and the sparsity of clinical facilities in obstetrics in most of our teaching institutions could have escaped the notice of the investigators. It is heartening to note in the report of the Council that their efforts looking to the further improvement in the teaching of obstetrics have not been relaxed. It is our cherished wish that the future efforts of the Committee on Medical Education will not be as abortive as in the instance just disclosed. I am indebted to Rudolph Holmes for the information that no obstetrician served on the committee of the Council—this I have since verified. The department of obstetrics had no friend in court, no one to plead its cause and judging from the brevity and evasiveness of the report the whole matter was none too seriously taken.

We will hope for better results in the future and we are not disheartened in contending for a square deal for obstetrics. Progress has been made and the good work will go on until obstetrics receives its just recognition.

446 AQUILA COURT.

AN ANALYSIS OF 128 INTERPOSITION OPERATIONS

By PAUL MESHBERG, M.D., PHILADELPHIA, PA.

(From the Gynecological Service of the Mt. Sinai Hospital)

THIS paper is based upon an analysis of 128 interposition operations performed for prolapse of the uterus at the Mt. Sinai Hospital, covering a period of eight years from 1922 to 1929 inclusive.

The 128 patients upon whom interposition operations were done were taken from two gynecologic services: 46 cases from the service of the late Dr. John Cooke Hirst, and 82 cases from the service of Dr. Charles Mazer.

AGE

The youngest patient was twenty-four years old, the oldest sixty-five years. The average age of this series was forty-two and thirty-two hundredths years.

TABLE I. AGE

6 patients were between 24 and 30 years old
19 patients were between 30 and 35 years old
36 patients were between 35 and 40 years old
39 patients were between 40 and 50 years old
23 patients were between 50 and 60 years old
5 patients were between 60 and 65 years old

TABLE II. SYMPTOMS

	CASES
Sensation of prolapse	88
Urinary frequency	58
Backache	41
Pain in lower abdomen	39
Leucorrhea	29
Menorrhagia, metrorrhagia, dysmenorrhea	23
Dragging sensation in pelvis	22
Incontinence of urine	11
Sacro-iliac pain	10
Rectal complaints	4
Pruritis vulvae	3
Constipation	2

The symptoms usually complained of in this series were sensation of prolapse, urinary frequency, incontinence, backache, pain in lower abdomen, leucorrhea, dragging sensation in pelvis, dysmenorrhea,

metrorrhagia, menorrhagia. Of these symptoms, the most complained of was sensation of prolapse, the next was urinary frequency.

The symptom of constipation is recorded in this series in only two cases, while other authors report this symptom in a greater percentage of cases. It is possible it was either overlooked, or the patients did not lay stress on it.

PATHOLOGY

Among the pathologic findings there were prolapse of first, second, and third degree, cervical erosions, cervical polyps, external and internal hemorrhoids, and retroversions.

TABLE III. PATHOLOGY

	CASES
Prolapse:	
First degree	29
Second degree	73
Third degree	26
Cervical erosions	21
Cervical polyps	4
Hemorrhoids, external and internal	14
Retroversions	9
Abscessed kidney with stones	1
Uterine subserous fibroids	2
Ventral hernias	2
Diabetes	2
Orthopedic deformity	1

OPERATIONS

Watkins' interposition operation was done in 122 instances, modified Watkins' in 5 instances, Wertheim's in one.

TABLE IV. OPERATIONS

	CASES
Watkins' interposition	122
Modified Watkins'	5
Wertheim's operation	1
Amputation of cervix	92
Curettage	50
Hemorrhoidectomies	14
Perineorrhaphies	128
Ligation of tubes	37
Myomectomies by vaginal route	2
Appendectomy	1
Exploratory laparotomy	1
Correction of ventral hernia	2
Plication of vesical sphincter	2

The Watkins' interposition operation was done on patients near menopause or past that age, and the modified operation was done on patients of childbearing age and below thirty years of age, where future pregnancies were considered. The tubes in these cases were not ligated. The modification consists in placing the first suture at

the level of ½ an inch below tubal insertion on anterior uterine wall and through vaginal fascias about ⅓ distance from urethra to cervix, not bringing the uterus through the peritoneal opening made.

The Wertheim's operation was done in one instance only because it was found on doing laparotomies on a few patients after they had had a Watkins' interposition operation some time before, the anterior peritoneal flap was firmly adherent to the uterus posteriorly, just as if it had been sutured to it.

Every one of the 128 patients had a perineorrhaphy.

The tubes were ligated in all patients near the menopause and where no more pregnancies were desired. In patients past menopausal age, the tubes were left alone. In patients, where future pregnancies were desired, the tubes were not touched and a modified Watkins' interposition operation was performed.

There must be some discrepancy in the figures reported in this series, as eleven patients complained of incontinence and only 2 had plications of vesical sphincter. Undoubtedly some by mistake were not recorded. The number of amputations of the cervix here reported is also small, as practically every patient who had a prolapse, had an amputation of the cervix with the interposition operation.

As a rule, the invariable procedure in the correction of prolapse of the uterus at the Mt. Sinai Hospital in every instance is amputation of cervix, Watkins' interposition operation. Häger's perineorrhaphy, ligation of tubes if near menopause, plication of vesical sphincter if there is incontinence, and curettage if metrorrhagia, menorrhagia, or dysmenorrhea are present.

Some patients had in addition to the interposition operation, some other operation at the same time. Two patients had myomectomies through the vaginal route, one had an appendectomy, one an exploratory laparotomy, 2 had correction of ventral hernias, 14 had hemorrhoidectomies at the same time the interposition operation was done.

COMPLICATIONS

The most troublesome complication was postoperative cystitis. Others are apparently more fortunate in this respect; their percentage of cystitis is much smaller. This can be explained by the fact, that most of the patients in this series were Jewish women, highly emotional, unable to void voluntarily while lying in bed. Almost every patient, with few exceptions, had to be catheterized several times a day for a few days after the operation, and some of them every day until they were able to stand on their feet. This resulted in a great number of bladder infections. Lately we started to use an indwelling mushroom catheter; this does away with frequent catheterizations, but does not prevent bladder infections.

We lay much stress on bladder infections, no case is overlooked. A catheterized specimen of every postoperative patient having had an

interposition operation was sent to the laboratory every third day and if the report came back with over 6-8 W. B. C. per high power field from a centrifuged specimen of urine, that patient was considered having cystitis. All patients with cystitis had bladder irrigations daily with 1:4000 silver nitrate solution until they cleared up.

One patient developed an acute attack of cholecystitis while recuperating from the interposition operation and had to have a cholecystectomy. Another patient unfortunately developed a pulmonary embolism and died.

TABLE V. COMPLICATIONS

	CASES
None	46
Cystitis	71
Suture infections	5
Phlebitis	4
Pneumonic	3
Shock during anesthesia	2
Parametritis	1
Pyelitis	1
Cholecystitis	1
Pulmonary embolism and death	1

STAY IN HOSPITAL

The lowest number of days of stay in hospital was fifteen days, the highest was sixty-four days, the average number of days was twenty-two. The complications developing after the operation were responsible for the patient staying in the hospital longer than fifteen to seventeen days, which is the usual number. One patient on Dr. Mazer's service had a nephrectomy first and two weeks later had an interposition operation.

MORBIDITY

Any rise in temperature above 99° F. was considered as morbidity.

TABLE VI. MORBIDITY

	CASES
None	33
Between 99° F. and 101° F.	67
Between 99° F. and 102° F.	13
Between 99° F. and 103° F.	7
Between 99° F. and 104° F.	3
Between 99° F. and 105° F. and above	2

END-RESULTS

The end-results were obtained in the following ways:

1. Through the records of the gynecologic clinic for clinic patients.

2. By direct examination of patients in the gynecologic clinic or in the office when possible.

3. Through the office records of Dr. Charles Mazer for his private patients.

4. Through letters mailed to patients in which they were requested to come for an examination and if unable to come to answer certain questions pertaining to the result of the operation.

Of the 128 patients, 92 were traced, one died, and 35 were untraced. Of the 92 traced patients, 83 had good anatomic results, 3 fair, and 6 had failures.

The 3 patients with fair anatomic results had recurrences of rectoceles, but the prolapse was cured. Adding the 3 fair to the 83 good, there is a total of 86 patients cured anatomically or 93.5 per cent, and anatomical failures 6.5 per cent.

Symptomatically 71 patients had good results, 14 fair, and 7 had bad results. Of the 14 patients with fair symptomatic results, 11 complained of urinary frequency, 3 of urinary frequency and incontinence, one of backache and sacroiliac pains. One patient was symptomatically worse than before the operation although the anatomic result was good.

Of the total 92 cases traced, 68 had good anatomic and good symptomatic results, 3 patients had fair anatomic and good symptomatic results, 14 patients had good anatomic and fair symptomatic results, one patient had good anatomic, but poor symptomatic results, 6 patients were failures anatomically and symptomatically.

If we consider the patients with fair symptomatic results as cured, because all of them had minor complaints and the prolapse was cured, adding the 71 cases with good symptomatic results to the 14 cases with fair results, we will have a total of 85 patients cured symptomatically. This leaves 7 patients with poor symptomatic results as failures or 7.6 per cent failure symptomatically.

TRACING TIME

The length of time elapsed since the operation up to the date the patients were last seen varied from three months to eight years.

TABLE VII.   TRACING TIME

40 patients traced between 3 months to 1 year	from date of operation
11 patients traced between 1 year to 2 years	from date of operation
7 patients traced between 2 years to 3 years	from date of operation
7 patients traced between 3 years to 4 years	from date of operation
9 patients traced between 4 years to 5 years	from date of operation
5 patients traced between 5 years to 6 years	from date of operation
9 patients traced between 6 years to 7 years	from date of operation
4 patients traced between 7 years to 8 years	from date of operation

The majority of women operated upon in this series belonged to the poor class, and as soon as they came home from the hospital they started to work, putting the recently performed operation to a severe test. Therefore, if in those patients who were examined three months

after the operation, good results were found, undoubtedly the operative results must be good even a few years later.

There was no difficulty in tracing all those patients reported in this series with some symptomatic or anatomic complaints, because they usually came in voluntarily for examination and expecting to be treated, feeling that the surgeon did not complete his work and owes them more treatments. Everyone with some complaint usually came in two or three weks after being discharged. As a matter of fact every patient upon discharge was instructed to come for an examination six weeks later either to Dr. Mazer's office, or to the gynecologic clinic, or to the family physician who referred the case for an operation, and if the results were found good, they were further instructed to come back if any complaint arises. It was impossible to miss partial or complete failures.

Some difficulty was met in tracing those patients with good anatomic and symptomatic results, as some of them receiving the letter to report for an examination answered they do not see any necessity to come, because they feel all right and there is nothing wrong with them.

Of the 35 untraced patients, 20 changed their addresses and could not be located, the other 15 did not respond.

<center>DISCUSSION</center>

Reviewing the literature for the last ten years on correction of prolapse of the uterus and end-results of such corrections, I found that no matter what form or method of an operation a surgeon selected for the correction of prolapse of the uterus, the average failure among different surgeons, at different hospitals, was between 10 and 12 per cent. In other words, each surgeon gets practically the same results, although he does it differently than the other.

It is not the writer's intention to criticize any form of operation for prolapse of the uterus nor to praise, but to bring facts as they are and to be taken at their worth.

Some gynecologists claim that the Watkins' interposition operation is the best for prolapse of the uterus on women near or past menopause, provided the uterus is not too large nor too small, and there is no pelvic inflammation. Other surgeons condemn it and under no circumstances would perform this operation, they resort to ventrosuspensions or ventrofixations followed by a vaginal plastic. Are these men right or wrong?

I believe that they are right, because the best operation for prolapse of the uterus is the one that gives success to the individual surgeon. One form of an operation for prolapse of the uterus may be a success in the hands of one surgeon, at the same time, the same operation and the same technic may be a failure in the hands of another surgeon.

To the gynecologists of Mt. Sinai Hospital, Watkins' interposition operation is the most logical and simple operation for prolapse of the

uterus, in selected cases near or past the menopause and when the uterus is not too large or too small.

SUMMARY

1. There were 128 interposition operations performed at the Mt. Sinai Hospital on two gynecologic services from 1922 to 1929 inclusive.

2. Ninety-two patients were traced, one died, and 35 patients were untraced.

3. Of the 92 cases traced, 83 were successful anatomically, 3 cases partially successful, 6 cases were failures or 6.5 per cent failures anatomically.

4. Of the 92 patients traced, 71 cases were successful symptomatically, 14 partially successful, and 7 cases were failures, or 7.6 per cent failures symptomatically.

5. The 14 patients partially successful symptomatically complained of one or two minor symptoms but the prolapse was cured, or 15 per cent partial success symptomatically.

6. The average failure of all forms of operations for prolapse of the uterus among different surgeons was from 10 to 12 per cent.

REFERENCES

(1) *Johnson:* Surg. Gynec. Obst. 42: 527, 1926. (2) *Grad:* AM. J. OBST. & GYNEC. 8: 163, 1924. (3) *Brady:* Surg. Gynec. Obst. 43: 476, 1926. (4) *Phaneuf:* AM. J. OBST. & GYNEC. 8: 322, 1924. (5) *Broad:* New York State J. M. 23: 885, 1929. (6) *Phaneuf:* New England J. M. 201: 875, 1929. (7) *Shaw:* Surg. Gynec. Obst. 34: 394, 1922. (8) *Miller:* Surg. Gynec. Obst. 38: 348, 1924. (9) *Vineberg:* AM. J. OBST. & GYNEC. 2: 368, 1921. (10) *Bullard:* AM. J. OBST. & GYNEC. 11: 623, 1926. (11) *Baer and Reis:* AM. J. OBST. & GYNEC. 17: 233, 1929. (12) *Baer and Reis:* AM. J. OBST. & GYNEC. 16: 646, 1928. (13) *Smith, Graves, and Pemberton:* AM. J. OBST. & GYNEC. 17: 669, 1929.

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A SIMPLE, RAPID PROCEDURE FOR THE LABORATORY DIAGNOSIS OF EARLY PREGNANCIES

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(From the Department of Physiology, University of Pennsylvania—With the Co-operation of the Department of Obstetrics, University Hospital, Medical School)

AN EXAMINATION of the work of Louria and Rosenzweig,[1] Brouha and Simonet,[2] Erhardt,[4] and Bruhle[3] could hardly fail to convince one that the test for pregnancy described by Zondek and Aschheim[5] is of great practical value. Yet this test, admirable though it is, has some distinct disadvantages, one of which may make it impractical in a laboratory or hospital not closely affiliated with some university or institute. To perform the Zondek-Aschheim test it is essential to be in a position to command a ready supply of immature mice weighing from six to eight grams. If a large breeding colony of mice is not easily available, some difficulty might be encountered in procuring suitable animals at the time a test was desired. Moreover, even if one had at hand enough of the immature mice to answer the calculated requirements for a given week, and, for some reason or other the number of samples submitted fell below expectations, the unused animals would soon mature beyond their usefulness, so that another group of the immature animals would have to be gotten.

It is believed that the procedure to be outlined here obviates this difficulty as well as some others inherent in the Zondek-Aschheim procedure. Our method rests upon three fundamental facts:

1. The ovaries of an isolated, unmated female rabbit contain neither corpora lutea nor corpora hemorrhagica, inasmuch as the rabbit does not ovulate spontaneously, but only after coitus.

2. The urine of pregnant women contains some substance, or substances, which simulate in their biologic effects the anterior lobe of the pituitary.

3. The ovary of the rabbit quickly responds to the injection of these substances by the formation of corpora lutea or corpora hemorrhagica.

The first fact has long been known, and has been used to advantage in the study of the reproductive activities of the rabbit.[6] The second fact, namely, that the urine of pregnant women contains the biologically active substances, was reported by Zondek and Aschheim, and is utilized by them in their test for pregnancy. That the ovary of the rabbit would respond promptly to the injection of urine from pregnant women was noted in some studies on the mechanism of ovulation in the rabbit,[7, 8] and confirmed by Jares[9] and by Hill and Parkes.[10]

TECHNIC

The materials and equipment necessary for the performance of the proposed test are: (1) an ordinary bedpan specimen of urine, (2) a five c.c. syringe, and (3) an unmated, mature female rabbit. The urine is injected intravenously thrice daily for two days in 4 c.c. doses. Forty-eight hours after the first injection the rabbit is killed. If the ovaries contain either fresh corpora lutea or large bulging corpora hemorrhagica, the reaction is positive and the patient who furnished the sample is presumably pregnant. If the ovaries contain neither corpora lutea nor corpora hemorrhagica, but only clear, unruptured follicles, regardless of their size, the reaction is negative.

A. *The selection and maintenance of rabbits.*—Inasmuch as the period of gestation in the rabbit is from thirty to thirty-two days, one may be certain that adult females strictly isolated from males for this period of time will not be pregnant, and that their ovaries will not contain either of the structures which characterize a positive reaction. Yet, if a number of females are kept together, it is possible that one doe may be ''hopped'' by another in heat and enter a period of pseudo-pregnancy which would last for about twenty days.[6] It is desirable, therefore, that the females be kept isolated not only from males, but from other females as well by placing them in individual cages. It is not a difficult matter to arrange with a rabbit dealer to have. a sufficient stock of females kept isolated in just such fashion for the desired period.

If by any chance, this is found difficult to arrange, one may buy adult females indiscriminately on the market and immediately place them in separate cages. After an interval of three weeks one can easily determine by palpation which of the rabbits are pregnant. Those that are found to be not pregnant at this time may be used immediately. In the event that some of the animals deliver young during this period of isolation, they may be used within twenty-four hours after parturition. Indeed, an animal that has just delivered a litter is a most desirable animal for the test.

In case, one has not had opportunity to isolate the rabbits for the desired period, and it is found necessary to perform a test, it is safe to use a rabbit that has been isolated in the laboratory for only eight or ten days. Even if the rabbit in question had had coitus just before it was obtained, the corpora lutea of pregnancy or pseudopregnancy would then be at least eight or ten days old, and could not be confused with the fresh corpora lutea or corpora hemorrhagica produced by the injections of an active urine.

Briefly, then, one may safely use all rabbits that are not demonstrably pregnant at the end of three weeks of isolation. In time of stress it will not cause confusion to inject a rabbit that has been isolated for only ten days, since the autopsy will disclose either that the corpora lutea are fresh, having been produced by the injections, or, that the injected animal was pregnant or pseudopregnant, in which case the result of the test might be discarded and another animal subjected to the injections.

It is understood, of course, that once the rabbits have been isolated for a sufficient length of time, they may be used at any time afterward.

B. *The storage of the samples and the injections.*—It is desirable to place the specimens on ice soon after collection. After the urine has become cooled a precipitate is likely to settle. If the urine is filtered while cold the precipitate may be removed without causing a noticeable loss of potency of the sample. Before each injection it is necessary to warm the sample in hot water for a few minutes so as to prevent shock to the animals. One must guard against overheating of the urine, however, for prolonged heating at 45° C., or more will decrease the potency of the specimen. After each injection the urine should be

returned to the cooler. No aseptic precautions are necessary either in the storage of the samples or during the process of the injections. If the material is handled in the manner just described, the potency of the active samples will not be materially impaired at the end of six days.

RESULTS

We have examined a total of 111 urine samples by our method. Of these, three proved to be so toxic that it was impossible to carry out the test. Of the remaining 108 specimens 25 were obtained from women in the last months of pregnancy, and each of these gave a positive reaction. In addition to these 25, positive reactions were obtained from the urines of 32 women presenting themselves to the maternity clinic for diagnosis at a time when a certain clinical diagnosis could not be made. We have been able to follow 22 of these 32 cases so as to check the laboratory diagnosis either by the detection of fetal heart sounds, or by unimpeachable evidence of abortion or miscarriage. An analysis of the thoroughly checked cases in which a positive reaction was obtained is presented in Table I.

TABLE I. CASES GIVING POSITIVE REACTION, SATISFACTORILY CHECKED[1]

STAGE	NUMBER OF CASES	REMARKS ON SUBSEQUENT CLINICAL HISTORY
7-9 months	25	Normal pregnancies—delivered
3 months	1	Normal pregnancy—delivered
10 weeks	1	F. H. S.
6-8 weeks	1	Suspected tubal pregnancy—Laparotomy
	1	Spotted once a month during pregnancy—F. H. S.
	2	F. H. S.
4-5 weeks	2	Irregular bleeding throughout pregnancy—F. H. S.
	5	F. H. S.
	1	Pernicious vomiting—aborted
	2	Miscarriage
	1	Aborted
3 weeks	1	F. H. S.
2 weeks	1	Ectopic, ruptured, laparotomy
	2	F. H. S.
10 days	1	Pulmonary T. B.—aborted
Total	47	

[1]In the column at the extreme left the stage of pregnancy at the time the sample was submitted is expressed in days, weeks or months since the first missed period. Under Subsequent Clinical History is indicated the ultimate fate of the pregnancy, "F. H. S." indicating fetal heart sounds detected, but pregnancy as yet not completed.

There remain the ten cases yielding positive reactions which we have been unable to check by the criteria we have chosen; namely, the detection of fetal heart sounds, or indisputable evidence of abortion or miscarriage. An analysis of these cases appears in Table II.

Of the 51 specimens giving negative reactions, two were obtained from normal males. Twenty-five were secured from women in the medical wards, known to have been nonpregnant at the time the test was performed. Among these cases were three of carcinoma of the ovary, two of carcinoma of the fundus uteri, one of carcinoma of the

cervix, and one of mediastinal tumor. The other specimens of this group were from convalescents in the medical ward. Twenty-four of the 51 negative reactions were gotten from the urine of women applying to the maternity clinic for diagnosis, and suspected of pregnancy at the time the sample was submitted. In 18 of these 24 women the possibility of pregnancy has since been excluded. We have lost contact with the other six.

Briefly, the laboratory diagnosis by our method has agreed with ultimate clinical diagnosis in each of the 92 cases for which we have adequate data. Although a final check has not been obtained on ten positive reactions, and on six negative reactions, we have so far been unable to discover a single error.

TABLE II. POSITIVE REACTIONS IN CASES NOT SATISFACTORILY CHECKED

STAGE	NUMBER OF CASES	REMARKS AND PRESENT CLINICAL DIAGNOSIS
3 months	1	Irregular bleeding, 4 months pregnant
7 weeks	1	Lost
4-5 weeks	2	Lost
	2	3 months pregnant
	1	History of miscarriage during third month of last pregnancy. Had profuse bleeding during third month of present suspected pregnancy. No physician present at the time to make certain of miscarriage. Ten days later specimen obtained which gave a negative reaction.
3 weeks	1	Too early for clinical diagnosis
13 days	1	2 months pregnant
11 days	1	3 months pregnant
Total	10	

DISCUSSION

From our results it seems obvious that the method we propose is adequately accurate for routine clinical use. We do not regard it as significant that the error by our method has so far been zero, while that of the Zondek-Aschheim test has been from 1 to 2 per cent. It is likely that if we had had more material, we might have encountered an error or two. There is further the possibility that in a number of rabbits kept isolated for several months the ovaries of a few may contain some follicles showing hemorrhagic degeneration. Although we doubt that the shrunken, degenerating follicles showing partial or complete hemorrhagic change will ever be confused with the large, bulging corpora hemorrhagica produced by the injections, one must recognize this source of error as possible though hardly probable. So far we have encountered this phenomenon of degenerative change but once, and in this instance the hemorrhagic follicles were shrunken to the size of pinpoints and could be confused with the corpora hemorrhagica of a positive reaction by no one.

Of course, there is also the disadvantage of toxicity in a small percentage of urines. This is quite as true of the Zondek-Aschheim procedure. With our method, we found 3 of 112 specimens too toxic to yield satisfactory results. Zondek reports that about 6 per cent[11] of the samples submitted were too toxic to be handled, and to obviate this difficulty, he has devised a method by which these toxic urines may be made innocuous. Since the appearance of this paper we have not encountered a sample with which to test his procedure.

Compared with the minor disadvantages of the use of the rabbit as we have proposed, are several real advantages. In the first place, the test as we have used it may be completed in forty-eight hours, as contrasted with one hundred hours for the performance of the original Zondek-Aschheim test. In an effort to decrease the time necessary for the performance of a test, Zondek proposes a method[11] of concentrating the active substances in the urines of pregnant women so that the test may be completed in about fifty hours. With this modified

Fig. 1.—A typical positive reaction showing the corpora hemorrhagica produced by the injections of urine from a pregnant woman.

technic, however, only positive reactions are significant. Really, if one were in a hurry, he could use two or more rabbits and sacrifice one or more of the animals eighteen hours after the first injection. In a large number of animals the ovarian changes will have occurred by this time, for, as reported previously,[8] even a single intravenous injection of urine from a pregnant woman can provoke ovulation in a rabbit within twelve to fourteen hours. Before the present routine was adopted, we did use the single intravenous dosage with the eighteen-hour autopsy, but found that it was not entirely reliable. Yet, in the event of necessity, this method could be employed, if one would not place too much faith in negative results. By this means crude urine may be used, thus avoiding the need of alcoholic precipitation and subsequent concentration of the active substances.

Another advantage of the method we propose is the ease with which the results can be determined. When the mouse is used as the test animal, a hand lens is needed frequently to determine the presence or absence of a positive reaction, and in about 12 per cent of the cases, microscopic study is required.[12] When the rabbit is used, the results

are perfectly apparent without the use of a lens or microscope at any time (Fig. 1).

Finally, only one rabbit need be used for each sample submitted. To perform the test of Zondek and Aschheim, five mice are prescribed for each sample because of the variability of response from mouse to mouse. Nevertheless, at the market price of $1.60 for each rabbit, and considering that a rabbit will consume more in a month than will five mice, it is likely that the procedure we have outlined will prove the more costly. This added expense is not great, however, and we believe that the other advantages will be of more weight than this item of expense.

SUMMARY

1. A procedure is described by which the injection of urine into female rabbits may be utilized in the diagnosis of early human pregnancies.

2. The results obtained with this procedure have proved to be correct in each of the 92 cases for which we have satisfactorily complete records. To date, we have been unable to discover a single instance wherein the laboratory findings were in error.

3. The advantages of the procedure, from the standpoint of speed and simplicity, are indicated.

REFERENCES

(1) *Louria and Rosenzweig:* J. A. M. A. 91: 1988, 1928. (2) *Brouha and Simonet:* Compt. Rend. d. Soc. de Biol. 99: 1384, 1928. (3) *Bruhle:* Deutsche med. Wchnschr. 55: 696, 1929. (4) *Erhardt:* Klin. Wchnschr. 8: 2033, 1929. (5) *Zondek and Aschheim:* Klin. Wchnschr. 7: 8, 1928. (6) *Hammond and Marshall:* Reproduction in the Rabbit, London, 1925, Oliver and Boyd. (7) *Friedman:* Proc. Soc. Exper. Biol. & Med. 26: 720, 1929. (8) *Friedman:* Am. J. Physiol. 90: 617, 1929. (9) *Jares:* Anat. Record 45: 264, 1930. (10) *Hill and Parkes:* J. Physiol. 69: Proceedings, XXIII, 1930. (11) *Zondek:* Klin. Wchnschr. 9: 964, 1930. (12) *Aschheim:* Zentralbl. f. Gynäk. 53: 15, 1929.

THYMOPHYSIN IN SELECTED CASES OF UTERINE INERTIA*

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THYMOPHYSIN is a combination of the extracts from the thymus and from the posterior lobe of the hypophysis. For the past five years it has been used for the treatment of inertia of the uterus in many of the European clinics. A review of the literature leaves one with the impression that thymophysin has the advantage over pituitrin in that it produces labor pains of a purely physiologic type and is without harm to the mother or child.

American publications by Haynes in 1928 and recently by Jarcho and Temesvary in the *American Journal of Obstetrics and Gynecology* seem to substantiate the reports with regard to the usefulness and relative safety of thymophysin. DeLee and Greenhill, however, in the 1929 *Year Book for Obstetrics and Gynecology* warn against the use of thymophysin. They state that thymophysin is a weak pituitary extract with all the faults of pituitrin.

In studying the effect of thymophysin in treatment of inertia of the uterus, it seemed best that only those cases that presented an obstetric problem should be used. Just because labor begins with rather weak and irregular pains can hardly be considered a sufficient indication for the administration of uterine stimulants. So many factors seem to alter the character and rhythm of labor pains that all such conflicting influences should be eliminated as far as it is possible to do so.

A period of rest with morphine or chloral and bromides is often followed by the onset of satisfactory pains with the result that labor is frequently terminated within the limits of normal duration. Rupture of the membranes frequently results in the onset of satisfactory pains. Effective pains may begin following vaginal examination, especially if the cervix has been manipulated during the examination and again the onset of good pains may start for no apparent reason.

This study, therefore, has only to deal with those cases of uterine inertia in which labor is unduly prolonged and in which the above factors have been excluded.

In two hundred and twenty consecutive deliveries per vaginam, labor was unduly prolonged because of uterine inertia in six cases, which were selected for this study. The method of selection was based upon the fulfillment of the following conditions:

First, that labor shall have lasted longer than ten hours without appreciable advance. During this period the pains should be of short duration and irregular in interval.

Second, that at least two hours shall have elapsed after a period of rest, vaginal examination or rupture of the membranes. At the end of this period of time the pains shall not have changed in frequency and character, and labor must be for all practical purposes at a standstill.

Third, that no disproportion shall exist between the pelvis and the fetal head.

CASE REPORTS

CASE 1.—Primipara went into labor August 9, 1928, at 4:00 P.M.; weak, irregular pains four to ten minutes, lasting fifteen seconds. Cervix well effaced, dilatation 1 cm. Weak pains continued with no progress until 9:00 P.M. Rested with morphine. Pains irregular in the morning of August 10, 1928; at 12 noon, dilatation was 4 cm., membranes were intact. At 4:00 P.M., dilatation was still 4 cm., and membranes were still intact; 10 minims of thymophysin were given. Ten minutes later strong effective pain, three minutes apart and lasting forty seconds. Heart tones were 160 and regular. At 6:00 P.M. dilatation was complete, the membranes were ruptured artificially and the position was left occiput transverse in the mid pelvis. The pains became weaker and at 9:00 P.M., little if any progress had been made; five minims of thymophysin were given and the pains became more frequent and of longer duration. At 9:30 P.M. pains were becoming less strong and the position of the head remained unchanged. At 10:00 P.M. patient delivered with Kielland forceps, left occiput transverse mid pelvis. The mother and baby were normal during their stay in the hospital and left in good condition.

CASE 2.—Primipara entered labor at 4:00 P.M., August 14, 1928; weak, irregular pains, cervix effaced, dilatation 1 cm., membranes intact. At 1:00 A.M., August 15, 1928, no progress. Patient rested with morphine and slept well for six hours. Had weak, irregular pains all day, August 15, 1928; rested by morphine at 10:00 P.M. and had four hours sleep. At 9:30 A.M., August 16, 1928, dilatation was 3 cm., membranes intact and head in left occiput transverse position; seven minims of thymophysin were given. Ten minutes later good pains, three to four minutes; lasting forty seconds. Patient delivered normally at 2:00 P.M., August 16, 1928. Mother and child normal during stay in hospital and left the hospital in good condition.

CASE 3.—Para ii entered the hospital in labor at 10:00 A.M.; had weak, irregular pains all day, cervix dilated 3 cm., position was right occiput posterior. Membranes ruptured spontaneously at 1:30 the next morning. No progress or change in character of pains at 3:30 A.M.; 7 minims thymophysin were given. Ten minutes later, good pains, two to three minutes apart, lasting thirty to forty seconds. Normal delivery, at 4:30 A.M. Child and mother normal during stay in hospital and left in good condition.

CASE 4.—Para iii; weak pains; dilatation 3 cm., cervix effaced, head in left occiput transverse position. Pains continued weak throughout the day and light. Patient rested with morphine at 9 A.M. the next morning and slept for five hours. Pains continued weak and irregular, dilatation 3 cm., membranes intact; apparently no progress; 5 minims of thymophysin were given at 2:00 P.M. with no results. Seven minims of thymophysin were given at 2:30 P.M. without apparent result in the character of the pains. At 3:00 P.M., 10 minims of thymophysin were

given and the pains became somewhat stronger but died down at 3:30 P.M. without producing any effect on the progress of labor. At 4:00 P.M. the membranes were ruptured artificially. The pains became more regular and delivery was accomplished at 11:00 P.M. after complete dilatation by Kielland forceps, left occiput transverse, mid pelvis. Mother and child normal during their stay in the hospital and left in good condition.

CASE 5.—Para iii, colored, entered after being in labor at home for thirty-six hours with membranes ruptured. After several hours of rest the pains were weak, irregular; dilatation 8 cm., right occiput transverse position. No progress for two hours. Ten minims of thymophysin were given. Five minutes later uterus went into tetany, heart tones fell to 60 per minute, meconium appeared in the amniotic fluid. Patient was put to sleep with ether and delivered with Kielland forceps. Baby was badly asphyxiated but was resuscitated. Mother and baby normal during stay in hospital and left in good condition.

CASE 6.—Primipara. On October 17, 1929 the cervix was dilated 3 cm., membranes in act, head in mid pelvis, occiput right transverse, heart tones regular and patient was having weak pains. There was no progress in nine hours. She was rested with morphine until 6:00 A.M., October 18, 1929; weak irregular pains continued, dilatation 3 cm., membranes intact. At 9:30 A.M. thymophysin, 10 minims, was given. Uterus went into tetanic contraction, heart tones fell below 100, increased fetal movements could be auscultated. Ether inhalation and morphine given to control tetany. The patient was delivered with Kielland forceps, right occiput transverse, thirty-six hours later. Amniotic fluid contained meconium. Mother and child were normal during stay in hospital and left in good condition.

Thymophysin used for the purpose of effecting satisfactory labor pains in this group of six selected cases of uterine inertia proved successful in two; aided the stage of dilatation in one, failed in one and produced uterine tetany in two.

It would seem that one would least expect uterine tetany to occur in the above cases because the uterus has contracted in such a feeble manner and does not appear to be irritable. Nevertheless, we feel that the appearance of uterine tetany is of some significance, especially when the dosage given was less than that usually recommended. At least several facts are quite evident from this group of cases. First, that thymophysin is not as reliable a preparation as one is apt to believe from the literature; second, that unless our experience is very unusual there must be similar experiences in other clinics where thymophysin has been used. We feel that the publication of our results obtained with thymophysin is indeed timely. We are not at all convinced that thymophysin is an entirely reliable and safe preparation, even in the face of an abundance of testimony to the contrary.

55 EAST WASHINGTON STREET.

A NEW METHOD FOR DETERMINING THE PATENCY OF THE TUBES IN THE COURSE OF ABDOMINAL OPERATIONS*

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(From the Department of Obstetrics and Gynecology, Washington University Medical School and Barnes Hospital)

WHILE working with Drs. Allen, Pratt and Bland[1, 2, 3] in a search for ova in the fallopian tubes of women, it occurred to us that the method we used, with some minor modifications, would be an ideal
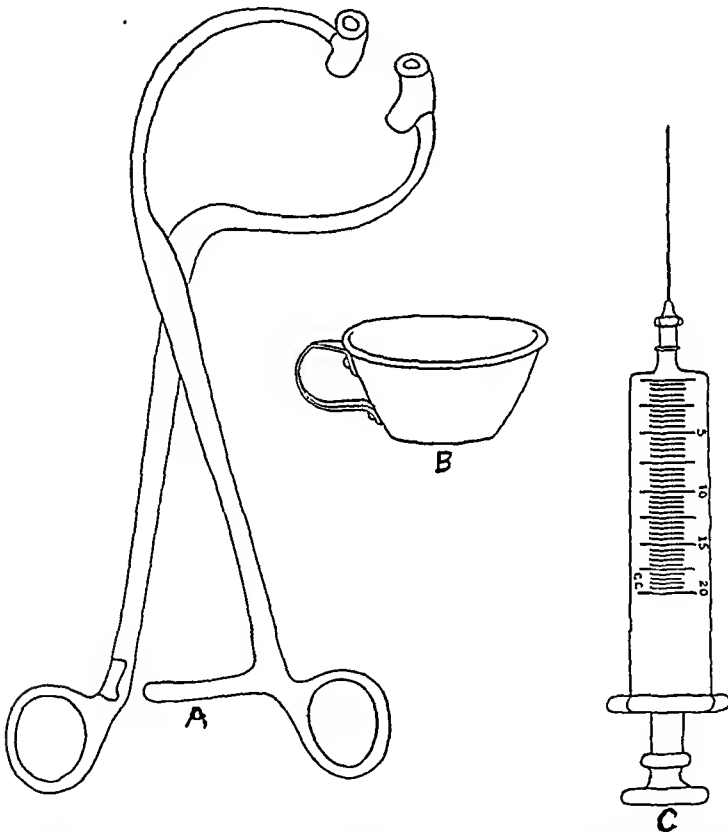
Fig. 1.—The necessary instruments for tubal insufflation when the abdomen is open. A. Uterine compression forceps. B. Cup. C. Syringe and needle.

procedure for determining tubal patency subsequent to plastic correction of obstructions revealed through a preceding hysterosalpingogram. A detailed description of the technic at present employed is as follows:

With the necessary plastic work done and intestines well packed away, a special uterine elevating forceps, the tips of which are covered

with rubber tubing to avoid any injury, is placed on the uterus from above downward, shutting off the cervix at about the level of the internal os (Fig. 1). This forceps is curved and is held forward by the first assistant. With thumb and index fingers of the other hand, this assistant compresses the tube on the side opposite the one to be tested for patency. The second assistant holds a small aluminum cup, 6 cm. wide and 3 cm. deep, having a handle for convenience (Fig. 2), underneath the fimbriated end of the tube to be tested to catch carefully all
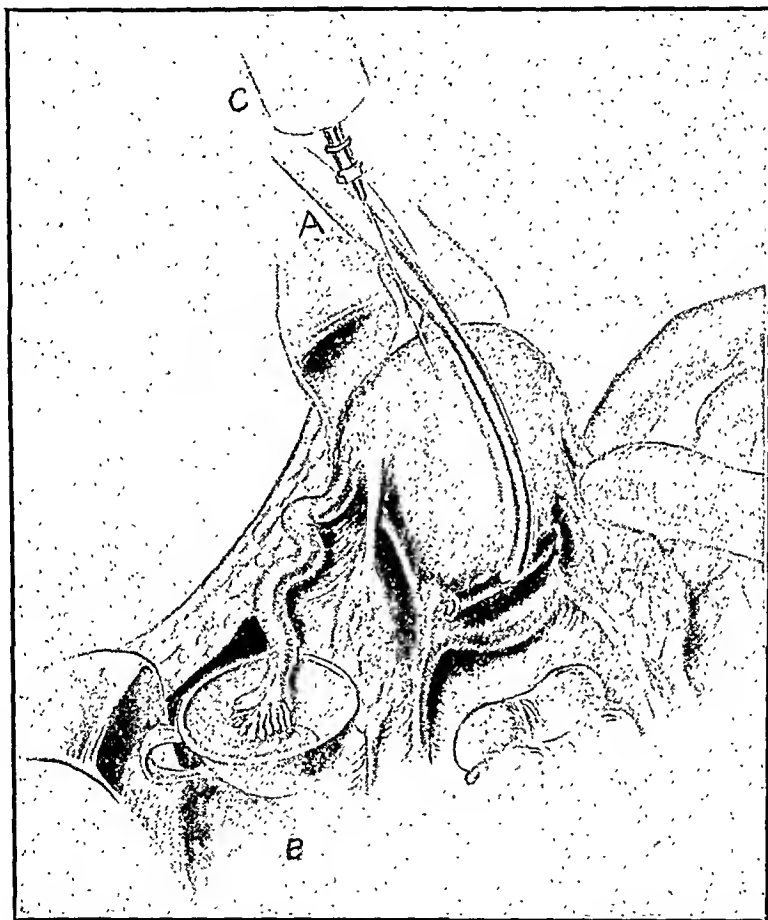
Fig. 2.—A drawing showing the method in operation. *A.* Uterine compression forceps. *B.* Cup. *C.* Syringe and needle.

of the passing irrigating fluid. A small calibered needle attached to a 20 c.c. syringe is pushed through the fundus into the uterine cavity, entrance into it being clearly perceived by a sudden cessation of resistance. Normal saline solution is then slowly injected. The uterus is filled up and gradual distention of the tube to be tested is observed to progress from the uterine toward the fimbriated end, granted the tube is patent. Several syringes full of fluid should be used for thorough irrigation since there is a possibility that this irrigating process might have some therapeutic effect.

This method has been used by me for the past two years and in no instance was any injurious effect noticed. I consider this method safer than similar procedures which unlike this one cause the injected material to enter the free abdominal cavity. The only contraindication would be an active infection in either uterus or tubes, but as a matter of fact under these conditions the operation for removal of a visualized obstruction should not have been attempted.

REFERENCES

(1) *Allen, Pratt, Newell, and Bland:* Contrib. Embryol., No. 127, Carnegie Pub. No. 414, pp. 45-76, November, 1930. (2) *Allen, Pratt, Newell, and Bland:* J. A. M. A. 93: 834, 1929. (3) *Newell, Allen, Pratt, and Bland:* Am. J. Obst. & Gynec. 19: 180, 1930.

411 Wall Building.

Gibberd, G. F.: A Contribution to the Study of the Maternal Death Rate. Lancet 2: 535, 1929.

The cases studied are divided into those occurring from 1863 to 1875, and 1919 to 1928, the two groups showing the comparisons of the midwifery of these periods.

The maternal mortality rate has fallen from 4.4 to 1.03 per 1000. Simultaneously there has been a steady increase in interference, but it is still less than 9 per cent. Improvement in aseptic and antiseptic technic has contributed much, particularly with the increased interference.

Antenatal care has its greatest value in reducing death in cases of disproportion and malpresentation, and in limiting the number of eclamptics along with the opportunity to prepare the patient to better face the risk of labor and the puerperium.

The concealed hemorrhages take about as many now as sixty years ago, while in cases of external hemorrhage a reduction in death rate has resulted principally from the use of saline, gum saline, and blood transfusions in conjunction with measures to combat the cause of hemorrhage. In toxemia, the greatest stride has been made in prevention and less in cure.

The intercurrent diseases took 0.32 and 0.24 per 1000 in the two respective periods.

H. C. Hesseltine.

Society Transactions

AMERICAN ASSOCIATION OF OBSTETRICIANS, GYNECOLO-GISTS AND ABDOMINAL SURGEONS*

FORTY-THIRD ANNUAL MEETING

NIAGARA FALLS, CANADA, SEPTEMBER 15, 16, 17, 1930

THE PRESIDENT, DR. EDGAR A. VANDER VEER, IN THE CHAIR

DR. I. W. POTTER, Buffalo, N. Y., Chairman, read a **Report of the Committee on Maternal Welfare.** (See page 290, February issue.)

ABSTRACT OF DISCUSSIONS

DR. A. M. MENDENHALL, INDIANAPOLIS, IND.—The preliminary figures as presented by Dr. Potter are indeed very discouraging. If we simply analyze those figures as presented in the first few pages of this paper, we cannot feel at all satisfied with the efforts we have been making in the past few years and are contemplating doing in the near future. But I am more optimistic than that. I have a feeling, in the first place, that prenatal care is eventually going to accomplish much more than it has in the past. The most encouraging statistics are those showing how much better the women have been who have had prenatal care.

I also believe that extension courses in certain States offer a good outlook in carrying the message of better obstetrics to the practitioner. This is more practical than expecting them to attend the state and national organizations. Naturally, we shall not feel the results of those things for years to come, but it is definitely worth while. At the White House Conference it was well said that we might teach obstetrics almost perfectly and yet, when the men leave the hospital they soon gravitate to the type of obstetrics done by the men who have been out longer, unless we continue to carry the teaching of better obstetrics to them and impress upon them the necessity of continuing it.

I have a feeling that marked progress is being made in the teaching of obstetrics and that our former President Findley's paper did much good. It has gone out to state organizations and most of our state journals reviewed it, giving the man in general practice an opportunity to see what is needed in obstetric teaching. In Indiana in the last two or three years we have practically doubled the hours that were allowed to obstetrics. Formerly surgery had the greater number of hours but now obstetrics is on practically an equal basis with surgery and we are hoping it will soon be on an equal basis with general medicine. A great aid to better obstetrics practice will follow without doubt, when the newly developed Board of Obstetricians and Gynecologists has become organized to the point of examining men for their qualifications in this speciality. Many now take a very short course in postgraduate obstetrics and then call themselves obstetricians. Obviously this Committee cannot overcome all of those obstacles, but I believe it will eventually do great good.

DR. JAMES R. BLOSS, HUNTINGTON, W. VA.—It is a matter of disappointment to those of us who are giving our attention to obstetric work to know that

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*The current volume of the Association Transactions will contain the complete discussion which cannot be presented here for lack of space, as well as those papers which were unsuited to the pages of this JOURNAL because of their purely surgical character.

there has been no improvement shown in the maternal death rate. It would seem that our efforts so far have not been productive of the improvement which we have been so earnestly striving for. The report of the Committee, however, very clearly brings out that we can do much to improve these conditions if we can only secure the cooperation of the prospective mothers with the physicians. The figures given in the report from the Report of the London East Side Maternity Hospital, and that of the Maternity Center Association, together with the Metropolitan Life Insurance Company, demonstrate where the trouble probably exists. It would seem, then, that our greatest effort should be extended toward educating the laity in regard to the importance of prenatal care.

There seems to be gradually growing the realization in the medical profession that the subject of obstetrics has not been given the proper amount of time in medical schools. Probably obstetrics has suffered in the curriculum because of the idea of the importance of the other fundamental branches of practice. It is a question as to how much this is affected by the financial returns from this branch of medical service. In the past it has been believed that anyone could deliver a woman, not realizing that obstetrics is the most important specialty in all of medical practice, and the poorest paid. As physicians in practice we can realize why the present status of obstetric service obtains. If the laity would be satisfied with the same brand of surgery, or the services of internists no better trained, then these branches would not make a showing any more commendable than the one brought forth by the study of these statistics. I do believe, though, from my contact with interns who have come more or less under my observation and supervision during the past two or three years, that they are giving evidence of better instruction. It seems that their obstetric conscience is better developed, and that they have a better foundation in the fundamentals of obstetric practice.

I heartily approve of the postgraduate courses which are being instituted at various points throughout the country. It seems to me that this Association should encourage this in every way.

The report of the Committee calls especial attention to the opportunity presented for us to get the maternal welfare idea to the laity when it deals with the question of interesting Parent-Teacher Associations and Mothers' Clubs. It seems to me that we have been overlooking a golden opportunity to get this educational work across. It is a very difficult thing, however, for a physician in a community to push himself forward and attempt to appear before these organizations. Surprising as it may seem, the other physicians in his locality belittle his efforts and make light of his attempt to better conditions. Immediately his confreres accuse him of advertising and of being unethical. We can readily understand that a sensitive physician with ability hesitates to subject himself to these unpleasant comments. As we know, generally the most competent men are the most retiring and least inclined to advertise in any way, and usually it results in the speakers being those who have not given the most thought to the subject.

So, in conclusion, it would seem that the most important thing at the present time is for this Association to have its committee give special attention to devising ways and means to bring before the laity the great importance of prenatal and postnatal care.

DR. BENJAMIN CARROLL, TOLEDO, OHIO.—For some time I have had in mind two suggestions along the same line of thought as that offered by the Committee. The first will aid in studying the cause and the second will help in lowering our maternal and fetal mortality rate.

First, at present, methods of arranging hospital statistics are not satisfactory and not entirely adequate. I would suggest that this Committee arrange a standard statistical form to be used by all hospitals, this form to be filled out for all pregnant women as they enter the hospital and again to be rechecked when the patient is dis-

missed; these daily or individual forms to be tabulated into a monthly report and monthly reports compiled into a yearly report. The hospital librarian, under the direction of the Chief of Obstetrics, shall be responsible for this data. By such a method of collecting statistics we would have readily available a uniform report from all of our hospitals. From such a report each hospital could make a comparative study of its own standing and would be stimulated toward more careful work.

My second suggestion is that a definite plan leading to a division of hospital obstetrics into major and minor cases be inaugurated by the Maternal Welfare Committee or a subcommittee. By comparison we have today as many good obstetricians in the communities surrounding our hospitals as the College of Surgeons had surgeons a few years ago when they reorganized the practice of surgery in the hospitals. (We also have as many inefficient men.) Last year in the cities approximately 50 per cent of the babies were delivered in the hospitals. Our mortality rate remains high. Not until our obstetric practice is on a plane equal to or higher than that of surgery will our hospital death rate be lowered. One, if not our foremost, duty as obstetricians is to make all of our hospitals "a safe place for confinement."

There are two other very good reasons for organizing hospital obstetrics. First, the interns, who in the past two or three years have shown a marked improvement in obstetric knowledge, are in these hospitals for their training. We must continue to impress upon them the importance of the abnormal obstetric cases. The second benefit of organized hospital obstetrics would be in paving the way and making a place for the new men, who have put in several years of intensive obstetric study.

DR. CHARLES S. BACON, CHICAGO, ILL.—The basis of the report, and of all our discussion is, statistics, and the importance of correct statistics is therofore great. Now it is impossible to get correct statistics unless there is uniformity in the records of different places and everything depends first upon the definitions, and second upon the carrying out of the rules of the statistics bureau of the community in which the records are kept. The definition of living birth is of the greatest importance. In many places the rule that every birth shall be called a living birth if there is any sign of life after delivery is followed; in other places a birth is not regarded as a living birth if there is simply action of the heart but no respiration.

The records in many places should, if made according to the direction of the office, include as living births children born after more than five months gestation showing any sign of life. In a hospital with which I am connected we carry out this rule. Every patient that is delivered where the duration of pregnancy is over five months, and where there has been any sign of life, is stated to have had a living birth. Necessarily we have a rather high fetal mortality because of that fact. It seems to me absurd to call a nonviable child a living child for the purposes of statistics, and efforts have been made by the Committee of the League of Nations in Geneva to bring about uniformity in definitions of living and dead births.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—We are convinced from the work which we have been doing on the White House Conference that the conditions in obstetrics are deplorable. It seems to me the point which we made some time ago should be emphasized, i.e., that all of this prenatal work is wasted money and time unless it is followed by consecutive, intelligent, aseptic obstetrics based upon a knowledge of the obstetric art and an obstetric conscience. There is something more to obstetrics than a clean hand and a sterile knife. This is brought home to me in an article published by the State Board of Health in Massachusetts, analyzing 370 primiparous obstetric deaths. Among the 370 patients 101 had cesarean section and over 50 of them died from peritonitis, embolus, shock, and hemorrhage. This means lack of obstetric conscience and if this Association hopes to accomplish any-

thing, it must begin, as has been suggested, to train our interns not only in the details of obstetric practice but also in their relation to the patient.

Many of these deaths are due to sepsis and toxemia, two of the supposed preventable conditions. If we go through any more statistics it will be seen that there has not been an appreciable decrease, not withstanding the propaganda which has been circulated in the past few years. We must go further and educate our public to a demand for better obstetrics, and do not forget that the doctor, no matter what amount of prenatal work he is doing, must follow it by intelligent delivery care.

DR. FRED L. ADAIR, CHICAGO, ILLINOIS.—The Joint Committee on Maternal Welfare was originally formed following a request from the American Child Health Association, consisting of three members each from this Association, the American Child Health Association, and the American Gynecological Society. There has been added to the membership the section of Obstetrics, Gynecology, and Abdominal Surgery of the American Medical Association. Many of the members of this Joint Committee have been very busy at the White House Conference, so that they have concentrated practically all their efforts in that direction. However, I believe that by close correlation and cooperation between the different communities we can accomplish much more for maternal welfare than by the activities of any committee representing only one organization.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—I wish to make two practical suggestions concerning the control of statistics and the study of the pathologic features that occur in this work. In each hospital when a junior member of the staff is appointed to the Department of Obstetrics and Gynecology, he should be given the responsibility of looking after the department's statistics. Before the record becomes a permanent item of the file it should be reviewed carefully to see that it is an available and useful record. Furthermore, the junior member of the staff ought to be capably trained in pathology. A large percentage of the members on the staffs of the larger hospitals are wholly incapable of reading gross specimens or microscopic sections. Appointments to the staff should, therefore, have adequate preparation for this work.

SYMPOSIUM ON THE HEMORRHAGES OF PREGNANCY

Management of the Third Stage of Labor, With Special Reference to Blood Loss, by DR. L. A. CALKINS, Kansas City, Mo. (See page 175, February issue.)

Placenta Previa, by DR. A. H. BILL, Cleveland, Ohio. (See page 227, February issue.)

Hemorrhage in the Early Months, by DR. W. B. HENDRY, Toronto, Canada. (See page 211, February issue.)

Accidental Hemorrhage, DR. J. O. POLAK, Brooklyn, N. Y. (See page 218, February issue.)

DISCUSSION

DR. I. W. POTTER, BUFFALO, N. Y.—I am inclined to doubt that the length of the second stage of labor does not increase the fetal deaths. The first stage of labor, it seems to me, has no effect whatsoever upon the patient.

The thing that impresses me in regard to blood loss in the third stage of labor is the location of the placenta. If the placenta is attached to the fundus of the

uterus, the blood loss is reduced to a minimum. If, however, it is attached to the uterine wall or comes into the group of previas, then the blood loss increases just in that proportion, regardless of whether the patient is treated or not.

Interference with the third stage of labor induces trouble, because it causes a greater blood loss, opens up avenues for infection, and leads one into considerable danger. If, however, immediately upon the separation of the placenta, it is removed from the uterus before it becomes a source of irritation, then the blood loss is again diminished.

In our experience we have not found that the blood loss in the third stage of labor has been increased by the general anesthetic. We use chloroform altogether. Pituitrin given after the birth of the child is routine treatment.

It seems to me that the size of the child can very easily increase the blood loss during the third stage. With a large child the tissues are more or less devitalized and the blood loss is greater in that case. The method of delivery has also something to do with the blood loss. I am speaking now from practical experience, but we do know that in a long, tedious second stage the blood loss is greater than when the second stage is shortened by immediate delivery of the child.

Regarding Dr. Bill's paper, there is only one suggestion that I would like to make—I would include placenta previas under one heading and not have three divisions. If it is a placenta previa, it is a placenta previa and is an operative case.

DR. G. D. ROYSTON, St. Louis, Mo.—Among 13,182 hospital admissions in the Washington University Clinic, there were 37 cases of placenta previa, 18 undoubted instances of premature separation, and 60 classified under accidental hemorrhage. A study of the history records of this latter group disclosed many with low-seated placenta, cervix eroded or traumatized during previous labors; others who had protracted general narcosis followed by atonic uterine contraction, etc. No doubt there were many instances of premature separation of slight degree that had escaped notice, but only those patients with symptoms resulting from a separation were so classified. I feel that there is too much guesswork in studying the placenta and attached clots with no exact knowledge of the cervix and lower uterine segment, to enable one to make a positive diagnosis.

Among 125 patients with eclampsia or preeclamptic toxemia, no instance of ablatio occurred.

DR. FRED L. ADAIR, Chicago, Ill.—The management of these bleeding cases is necessarily complicated by considerations due to the maternal life and health and that of the fetus in utero, except where the offspring is already dead or previable. Even in uterine bleeding in the early months of gestation one is actuated by a desire to preserve the embryonic and fetal life in the management of threatened abortion. The treatment of threatened previable terminations of pregnancy with bleeding is to carry on to the period of viability if it is consistent with the health and life of the mother, by complete rest, with the administration of opium or morphine and belladonna or atropine, all under supervision and control of the patient in appropriate surroundings. When the process becomes inevitable, the uterus should be encouraged to empty itself, but great caution must be used in the employment of artificial means in potentially and actually infected cases. If the bleeding necessitates intrauterine manipulations, they should be carried out with great gentleness in an effort to avoid breaking down the natural barriers to infection. In noninfected cases the uterus may be artificially emptied with relatively little danger, though instrumentation of any pregnant uterus is fraught with the danger of serious trauma.

Under ideal conditions, with a properly equipped maternity hospital and competent personnel, a section is a desirable procedure in properly selected cases of

placenta previa but it is probably not needed in all. In the vast majority of cases such ideal conditions are not at hand and other methods must be used.

The obstetrician must avoid provoking any bleeding by rectal or vaginal examination until everything is ready to proceed in accordance with an outlined plan to control bleeding and secure cervical dilatation. If possible, all of these cases should be adequately hospitalized. Haste in delivery through inadequately prepared passages is to be rigorously avoided.

I will quote a few statistics from the Chicago Lying-In Hospital. There were 144 cases of placenta previa in approximately 15,000 deliveries. · The incidence of cesarean section of various types in these cases was 42, or approximately 29 per cent. There were two maternal deaths in the series, which makes the maternal mortality from placenta previa about 0.75. Neither of these deaths occurred in a mother who had a cesarean section.

Among the 15,000 cases at the Chicago Lying-In Hospital mentioned above there were 113 cases of abruptio placentae. There were five maternal deaths which make a maternal mortality of 4.4 per cent. In this series there were 26 cesarean sections of different types, a percentage of 23.

DR. E. D. PLASS, Iowa City, Ia.—Dr. Calkins was unable to utilize my cases in the determination of the effect of parity upon the amount of postpartum bleeding. These figures have been analyzed and show that, while there is no difference in blood loss in the average patient, multiparity does increase the chance of a postpartum hemorrhage with a blood loss of 600 c.c. or more.

Among 613 primiparous women in my series, there were 38 or 6.2 per cent, who lost 600 c.c. or more of blood, while among 557 multiparas, 64, or 11.2 per cent suffered a postpartum hemorrhage according to the criteria.

I would like also to emphasize that the kind of anesthesia employed has an effect upon the blood loss. Some years ago we reported upon the apparent effect of ether, either alone or in conjunction with another inhalation anesthetic, in promoting bleeding. Further experience has confirmed these observations. Our recent experience with chloroform has been too meager to permit conclusions to be drawn concerning its effect, and the newer agents have not been studied with this in mind.

We have held that the use of transfusions to combat the blood loss and shock in patients with placenta previa is the essential feature of the treatment, believing that if the patient is restored to good general condition, treatment either with the bag or by cesarean section will be satisfactory. My personal objection to the employment of abdominal delivery is that advanced against its use in all incidental indications—the same operation will be done in each succeeding pregnancy even when there is no indication other than the previous operation.

DR. J. C. LITZENBERG, Minneapolis, Minn.—This is an age of prophylactic thinking. The paper of Dr. Calkins, read this morning, directs itself to the prophylaxis of the loss of blood. We should cease thinking of obstetric cases in terms of mortality, or we might go even further and think in terms of the physiology of the woman, the slight disturbance of her health. It would seem unnecessary to argue before this audience that the conservation of every ounce of blood possible will lead to a more rapid recovery and the more certain return and maintenance of health.

As surgeons we emphasize a delicate handling of tissues. That often. is the mark that distinguishes the expert surgeon from the mauler and that has to do with the health of the individual. We no longer operate in a sea of blood, but try to conserve every drop of blood possible.

Dr. Calkins did not tell you that the average loss of blood in his cases was 200 c.c. All of Dr. Plass's cases were privately conducted and the loss of blood

was 290 c.c. Our average loss of blood at the Minnesota Hospital is 450 c.c. I consider 300 c.c. as a postpartum hemorrhage, either that some accident has occurred beyond my control or I have not handled that case properly. I commend the technic which has been spoken of. Perhaps the bleeding in our clinic at the University of Minnesota more nearly approaches the average private case. Our cases are handled either by the resident or an intern. If we call ourselves expert obstetricians, I do not believe we should have a loss of over 300 c.c. of blood, and our figures for postpartum hemorrhage should be lowered, in general, at least from 600 to 500 c.c., and in the hands of experts to 300 c.c., unless the hemorrhage is due to something beyond our control.

In teaching students the Credé method correctly one must insist that the hand be placed behind the uterus as far as possible, with the thumb in front, and the uterus squeezed and not pushed. That eliminates the danger of pushing the cervix down where it may become infected. In this technic it is ever necessary to keep in mind that massage, unusual massage particularly, should not be used.

DR. JOSEPH L. BAER, CHICAGO, ILL.—I should like to outline for you the successive procedures tried out in the treatment of the third stage under my observation at the Michael Reese Hospital from 1904 to 1930. I was taught to hold the uterus for one hour after the end of the second stage whether placenta had been delivered or not. For one hour either the intern or the nurse had to hold the uterus, massaging as they saw fit for softening or bleeding. Then that period was cut down to thirty minutes during which no attempt at expression could be made. At the end of the thirty minutes the placenta was to be expressed or delivered by the Credé method if it had not come away spontaneously. Then in 1919, after we had run out of ergot because of the War conditions, we stopped the use of ergot which heretofore had been routine; we found that there was no difference in the third stage bleeding without the administration of ergot, so we permanently omitted the routine use of ergot. Then in 1925, following a presentation by Dr. Danforth on the routine use of pituitrin, we began using that, one-half ampule at the end of the second stage, and one-half ampule after the placenta had been delivered.

During these last years, however, we have completely discontinued holding the uterus. For a period of ten years we placed the hand across the abdomen in diaphragm fashion above the uterus without holding it, merely touching it to give us contact information. That was initiated when we used pituitrin.

In 1918, during the period of holding the uterus and giving ergot routinely, in 1,000 consecutive cases the average length of the third stage of labor was twenty-seven and a half minutes; in 1930, in 1595 cases, without touching the uterus except to determine its consistency, and with the use of pituitrin instead of ergot, the average length of the third stage was nine minutes. In 1918 we

TABULATION OF THIRD STAGE DATA DURING 1918 AND 1929

1918		1929
	Duration of Third Stage	
27.5	Average	9.2 %
97.1%	Less than 30 min.	98.4 %
2.9%	Over 30 min.	1.6 %
	Hemorrhage	
3.0%	Slight and moderate	2.92%
0.3%	Severe	0.26%
3.3%	Total	3.18%
	Placenta	
0.9%	Manual removal	0.94%
0.5%	For hemorrhage	0.5 %
0.4%	Adherent	0.44%

did not do any manipulating to force the placenta out. We simply held the uterus for thirty minutes, whether the placenta appeared at the vulva or not, and at the end of thirty minutes expressed it.

We are almost convinced now that the routine use of pituitrin is superfluous and makes no real difference in the loss of blood in the third stage.

I believe that holding the uterus, likewise is totally unnecessary and frequently harmful, because holding the uterus before the placenta has been separated not infrequently includes massage for the softening of the uterine wall which is really normal relaxation, and results in irregular separation of the placenta with resultant increased bleeding and retention of a partially adherent placenta. Holding the uterus after separation is certainly superfluous because, so far as we can determine, it plays no part in the control of blood loss. Separation is the important consideration in the third stage. This can be determined without holding to the uterus. Frequent palpation is better and safer. Bleeding from the vulva is valuable evidence. We tie a bit of tape on the cord, and the advancement of that mark is another very good index. Again, the alteration of the contour of the fundus is significant. As it rises and becomes conical, it shows that the placenta has moved down into the lower uterine segment.

I believe that in the majority of instances there is no need for expression after the placenta has separated. If the woman is awake and of a cooperative nature, one need merely pull the recti together above the fundus in the upper abdomen, thus reconstructing the intraabdominal pressure at the height of a contraction, and in 90 per cent of our series the patient expels her placenta, using her uterus as the piston to drive the placenta out of the birth canal. I described that procedure eleven years ago. It has won very general recognition on the Continent and is used in Western Europe quite routinely. Its acceptance has been a little slow in this country, perhaps because many of our patients in the third stage are under the influence of a drug or anesthetic.

If I may say one word more in discord, I cannot agree with classifying placenta previas as placenta previas and nothing else. Neither can I agree with the complete omission of vaginal examination on hospital patients. In a long series of vaginal and rectal examinations Dr. Ralph Reis, of our clinic, found that the morbidity at the end of the complete series was identical. We have no fear about doing a vaginal examination on admission to determine the *status presens* of the patient whom we are considering. We do prescribe that a woman who is bleeding when admitted to the hospital shall not be examined by the house staff. A member of the staff is always available to do vaginal examinations, and I cannot agree that in a multipara, in whom the placenta is situated very eccentrically, as revealed by vaginal examination, it would be justifiable to deliver her by an abdominal operation. Simple rupture of the membranes, not to reenumerate the other procedures, has more than once closed the whole chapter of a placenta previa without any further intervention. Why do a section on that type of patient?

DR. ALEXANDER M. CAMPBELL, GRAND RAPIDS, MICH.—We employ a very simple method of preventing excessive hemorrhage by tamponade of the uterus. For the last two years we have been doing routinely immediate repair of the cervix following labor, and in working out this technic it occurred to me what a simple thing it is to pack carefully a bleeding uterus when one uses the DeLee vaginal retractors and proper tenacula. I maintain that if proper care is taken and if this technic is followed, there is practically no danger of infection. We have used this method in a sufficient number of cases without the slightest morbidity. We believe that careful tamponade of the uterus is much preferable to, and much more effective, than the forcible massage which is so often used in an attempt to control excessive postpartum bleeding.

Concerning placenta previa, I want to state that, as a practitioner who has followed the statistics on cesarean section for many years, I am glad that there are other members of this Association who do not take such a radical attitude as to advise cesarean section in every case of placenta previa. I think every such case is a law to itself and I am convinced that some cases will deliver themselves spontaneously and safely and that a number of cases may be successfully delivered by the use of a dilating bag.

I will admit that cesarean section is a procedure of choice in many cases when it can be done by a skillful operator and under favorable circumstances, but I think that the statement that every case of placenta previa should be submitted to cesarean section is a very dangerous one to emanate from this Association.

DR. W. S. BAINBRIDGE, NEW YORK CITY.—*I am wondering* whether in considering the question of hemorrhage, we have taken into consideration the physiologic chemistry of the blood? Where it has been possible, I have tried for years to get the coagulation time of the blood, and where possible, also the calcium content, although the coagulation time carefully done will give us a general rough view of the physiologic element in relation to coagulation. If the coagulation time is from seven to fifteen minutes, a few days of adequate medication will safeguard the patient and diminish hemorrhage. I question whether we are not often derelict in not paying more attention in our surgical work to blood chemistry.

DR. C. R. HANNAH, DALLAS, TEXAS.—I was particularly impressed with the discussion of Dr. Baer. Whenever we think of labor, we think of uterine contractions and these contractions are present through the first, second, and third stages of labor. I have observed often that a patient will complain of painful contractions during the third stage of labor almost equal to those of the first stage. These contractions of the third stage are of such severity at times that an anesthetic is necessary for relief. These painful contractions may mislead us, and cause the attending obstetrician to attempt to express the placenta before separation. The third stage of labor should be thought of as of two stages: first, separation; second, expulsion. An attempt should not be made to express the placenta until it is separated, which is recognized by the ascension of the fundus of the uterus near the diaphragm, inasmuch as this maneuver will increase the loss of blood. Rough manipulation of the uterus produces bleeding. Unless pathologic, the third stage should not be hurried if we desire to prevent the loss of blood. After separation of the placenta, and during a contraction, place the palms of the hands over the recti muscles, which act as a support, and have the patient bear down; thus the placenta is expelled without an unusual loss of blood. Pituitary extract is not indicated in a normal third stage of labor; but, if given, it should *follow* the expulsion of the placenta in normally conducted cases of labor.

DR. ALONZO K. PAINE, BOSTON, MASS.—For a number of years the Section of Obstetrics and Gynecology of the Massachusetts Medical Society has been studying maternal mortality in Massachusetts; the statistics indicate that next to sepsis, hemorrhage is responsible for the largest number of maternal deaths, and that in these hemorrhage cases the placenta previas play a conspicuous part. I am especially interested, from the standpoint of teaching, in the adoption of a more or less standardized treatment for these placenta previa cases. I was glad to hear Dr. Bill minimize the importance of the variety in a given case. Dr. Potter puts it strongly when he says there is only one variety of placenta previa. It also seems to me that the wisdom of vaginal examination in these cases before the onset of labor is open to question. The existence of placenta previa can usually be established without such an examination, and the additional knowledge secured is of doubtful value in many cases; valuable time may be lost and hemorrhage increased by the procedure.

For a number of years in teaching I have emphasized two things as important in determining procedure; the symptom itself, bleeding, and the time of its occurrence. In a general way, if definite bleeding occurs before the onset of labor, the case is a potential cesarean. If this symptom appears in the seventh or eighth month, is slight in amount and ceases quickly one is justified, with the patient in a hospital bed, in waiting from day to day until the baby is reasonably viable. Recurrent flow indicates the unwisdom of further delay and a cesarean should be done. Procedure, when bleeding begins after the onset of labor, depends on the degree of dilatation of the os. If there is slight or no dilatation, cesarean section still is the procedure of choice. If the os is sufficiently dilated to permit the easy introduction of a bag, it seems the conservative procedure. If a considerable degree of dilatation is present, simple rupture of the membranes will often suffice to control bleeding. In cases where complete dilatation is easily secured, its completion manually, followed by immediate extraction, is good treatment.

DR. D. L. JACKSON, BOSTON, MASS.—Whether or not we believe in the routine use of pituitrin in the third stage, whether or not we believe in holding the fundus of the uterus, it is true that some uteri do not contract well after the placenta is delivered. In these cases where relaxation is present and bleeding is alarming, I have found that the use of pituitrin intravenously, in two or three minim doses, acts miraculously, clamping the uterus down tightly, almost before the administering syringe can be laid down and the hand returned to the fundus.

The second point I wish to emphasize is the value of getting the patient's legs out of the stirrups and getting her flat as soon as possible after delivery. This simple maneuver accomplishes the very thing Dr. Calkin mentioned; viz., it causes the uterus to come out of the pelvis up into the abdominal cavity.

DR. A. J. RONGY, NEW YORK CITY.—Bleeding toward the end of gestation must be considered in the light of a displaced pregnancy and ought to be treated as such. A misplaced nidation during the early period of gestation leads to an ectopic pregnancy. A misplaced nidation in the last six weeks results in a placenta previa. In either instance occasionally the patient may be able to get along without surgical intervention, for tubal abortion may take place and the patient gets well; the same happens in a large number of cases of placenta previa: labor sets in, the presenting part presses on the abnormally situated placenta, bleeding is controlled in that way, the child is born, and the placenta delivered with very little complication. However, placenta previa causing bleeding before the woman is in labor, before there is any dilatation, the cervix still rigid, and no presenting part to press upon the placenta, must be viewed in the same light as an unruptured ectopic pregnancy. In these cases the safest method of delivery for both mother and child is cesarean section.

During the third stage of labor, the variation in the quantity of blood lost depends to a large degree upon the coagulability of the blood of the particular patient, for in addition to the closure of the sinuses of the uterine surface at the placental site, it is also necessary that coagulation take place at the opening of those sinuses, and the sooner that takes place the sooner will bleeding or oozing cease.

DR. FOSTER S. KELLOGG, BOSTON, MASS.—It seems to me we should be slow to accept chronic nephritis as the etiologic factor in ablatio in as high a percentage as Dr. Polak suggests. Williams states in the new edition of his textbook that he saw but two cases in his series of 57. In our series we have been unable so far to establish a single case of certain chronic nephritis by interval study. Autopsy material carefully studied in relation to the kidney is very scant. We have finally in one instance found a kidney with infarct formation with desquamation of the tubular epithelium beyond. This is the picture of the characteristic

pathology of the liver in eclampsia. It also accounts for the characteristic picture of the detritus-filled tubules with attempts at epithelial regeneration described by Couvelaire and seen by us, and called by Mallory "late tubular nephritis." In contradistinction to Williams we have found in one autopsy in a patient who did not have convulsions, typical eclamptic liver lesions. We have reported eight cases (now ten) in which separation occurred on or about the time of the disappearance of albumin and elevated blood pressure in patients with nonconvulsive toxemia. Further, we reported five cases of ablatio associated with convulsive toxemia and called attention to the fact that each had one or more convulsions prior to placental separation.

DR. E. L. CORNELL, CHICAGO, ILL.—I want to emphasize the fact that we so seldom treat these hemorrhage cases prophylactically. We should give the pregnant woman, as part of her prenatal care, calcium in some form during the latter months of her pregnancy. Today most women are delivered under some form of anesthesia, either ethylene, nitrous oxide or ether; therefore the uterus at the last end of the second stage does not contract as readily as it would without any anesthetic.

A third factor, which plays an important part is the rapid delivery of the body, after the head is born. The uterus loses its opportunity to contract and retract.

Another detail in the management of the third stage is that the patient should have from 7½ to 20 minims of pituitrin as soon as the head is born and before the shoulders are delivered. During the war we were unable to obtain packing material, so we instituted the use of pituitrin in the beginning of the third stage or at the end of the second stage of labor and since then postpartum hemorrhages have markedly increased.

I know of no way to predetermine the amount of blood any one individual will lose in any type of placenta previa; therefore, I agree with Dr. Bill that until we are able to predetermine the amount of bleeding in any patient, the cesarean section in cases with a closed cervix offers the best results.

DR. ALBERT MATHIEU, PORTLAND, ORE.—The completion of the third stage of labor does not preclude the possibility of hemorrhage. I think the patient should be left in the delivery room one hour following delivery; that the uterus should be watched, not by the one who is cleaning up the delivery room, but by one designated for that purpose; and that the doctor should stay in the hospital for one hour following delivery. I know of two deaths that might have been prevented had the patients been watched in this way, and I think I have on two occasions saved the life of a patient by being in the hospital when the hemorrhage began.

DR. JAMES K. QUIGLEY, ROCHESTER, N. Y.—There would seem to be one other reason for not packing the uterus; namely, the development of a chronic endometritis and separation of the placenta in these cases in subsequent pregnancy. I believe in packing the uterus rarely and we should pack through the large Harper tube whereby the gauze at no time comes in contact with anything except the uterus.

DR. CALKINS (closing).—I would say to Dr. Bainbridge that we have routinely taken the coagulation time for several hundred cases and so far it has been found to have no effect on the blood loss. We have not routinely made blood calcium determinations but we do routinely give calcium to all of our patients.

Dr. Hannah called attention to the manner of giving pituitary extract. We never give it until after the placenta is delivered; therefore, we do not give it in the third stage but at the completion of the third stage.

I am very glad that Dr. Baer sounded a discordant note. He pointed out that the alteration in contour of the uterus is an important sign of the separation of the placenta from the uterus. I should like to ask whether he can *see* that contour, or does he *feel* it with his hands? Ahlfeld, years ago, called our attention to the fact that only 14 per cent of all women would spontaneously express their own placentas. He had a series of several thousand cases. Williams has repeatedly called attention to that fact in each edition of his textbook.

In justification of the technic recommended for the management of the third stage of labor I would like to call attention to the fact that our figures are based on *measurement* (not estimation) of blood loss, 210 c.c. being the average blood loss, including all cases. For example, we had one patient with 2500 c.c. of blood loss in the uterus, in a case of ablatio placentae. That case is included in the average. The average is little more than one-half of the smallest previously published average. The smallest was that of Williams in the Hopkins clinic, 343 c.c. in 1000 cases. The other averages have been 500 c.c. or more.

It is a fact that too much anesthesia will produce more blood loss, regardless of the agent used. It is also true that ether will produce more bleeding than nitrous oxide, and that ethylene will produce more bleeding than nitrous oxide. Lacerations or operative procedures of any sort will increase the amount of bleeding. Hydramnios, twins, placenta previa, etc., increase the bleeding. I was considering the variation in blood loss in normal labor primarily.

DR. BILL (closing).—By way of general discussion, fifteen years ago, in a paper prepared for the Ohio State Medical Society, I advocated the routine use of pituitary extract in the third stage of labor. We have used this routinely ever since, in probably more than 40,000 cases. We have had no trouble from it whatever. Our feeling is that there is no single thing that has done as much in preventing postpartum hemorrhage as the routine use of pituitary extract as soon as a child has been born. We give a full cubic centimeter at this time.

In regard to my own paper, let me again emphasize that of first importance is the examination of the patient's condition by careful blood examination and blood pressure reading, to determine whether she is a fit subject for delivery. If she is not, a sufficient blood transfusion should be given her to make her a fit subject. We have given as high as 2200 c.c. in a single case.

As to the examination, I believe that absolutely nothing can be gained by vaginal examination. One discussant said it was radical to do a cesarean in a "supposed" case of placenta previa. It is possible to make a diagnosis of placenta previa without examination. Our comparatively low incidence of placenta previa, one in 330 cases, is proof enough that none but real cases of placenta previa have been treated in this way. Further, you must realize that vaginal examinations only add to the danger of infection and that manipulation often causes serious hemorrhage which means an unnecessary loss of blood to the patient.

As to the method of delivery where forcible dilatation of the os is accomplished, no matter how gently, there will always be cases of postpartum hemorrhage, and I believe that the only cases in which we can be absolutely sure that there will not be postpartum hemorrhage are the ones in which we leave the placental site untouched; that is, cases treated by abdominal cesarean section.

(To be continued.)

NEW YORK OBSTETRICAL SOCIETY

MEETING OF OCTOBER 14, 1930

Dr. F. W. Rice reported a case of **Acute Yellow Atrophy of the Liver During Pregnancy with Recovery.**

Drs. E. C. Lyon, Jr., and G. G. Bemis (by invitation) presented a paper entitled **A Study of Neonatal Deaths Occurring in 6000 Consecutive Deliveries.** (For original article see page 373.)

ABSTRACT OF DISCUSSION

DR. WALTER LESTER CARR.—The interwoven character, medical and obstetric, of the report would show the necessity for medical prenatal care being continued during all the time the mother is under observation. There are certain factors which I think we must consider in neonatal deaths, not always detected even though blood and urine examinations are made. For example, a patient contracts influenza just about the time of her confinement and the baby dies of influenza. Such things, I think must be studied in making an analysis of a group of neonatal deaths.

At the Woman's Hospital we examined 200 babies for bleeding and coagulation time to determine whether in babies born with injuries such as cerebral hemorrhage or a tentorial tear, which could not be reached, we could at least inject blood or serum. At present it would appear that we are much better off than when we let those children go without doing anything for them.

Referring to atelectasis and pneumonia, I believe there is no doubt that atelectasis is frequently followed by bronchopneumonia in weak and premature babies.

In the premature and weak groups we must encourage artificial respiration. We cannot, however, always make the baby breathe because the musculature is weak but by proper and not too energetic attention and by the use of oxygen we will be able to get better results.

As for congenital defects, occasionally there is a baby suitable for operation and in one instance of atresia of the duodenum, operation saved the baby, which led us to believe that the way was opened for further operative intervention for this type of defect but the next time a baby had the same symptoms, operation was urged, was not accepted and the child died. The autopsy findings in the latter case showed an atresia too extensive for resection. While there was a mortality of 50 per cent in these two cases, we still felt that the matter of operation in such cases is worthy of attention. Some of the cases of jaundice gave us considerable thought, and various tests have been carried out, and we have felt that these were not always an index of whether the case was a surgical one or not.

Statistical results indicate that greater attention is being paid to newborn babies and while any institution is liable to have an epidemic, such as influenza, this might be avoided or at least minimized by watching the mothers and nurses and at the first sign of influenza having the children isolated and observed for respiratory infection. However, the difficulty is that respiratory infection may be conveyed to a number of babies who show very little rise of temperature for the first day or two and apparently very little change in the upper respiratory tract or naso-

pharynx but because the nasal spaces in babies are so small there is liable to be a quick collapse from descending infection.

DR. LYON (closing).—We have been studying of late the thymus gland in a series of apparently normal babies, having them all x-rayed on the fifth day, to try to determine an index, if possible, for a normal thymus. It is difficult to interpret these x-rays. We have had babies that we felt clinically showed definite symptoms of embarrassment due to an enlargement; these we have treated by x-ray, but in this group in the past eleven years we have not had any cases in which the thymus was the cause of death.

The case of hemorrhage into the adrenals we felt was due probably to handling at the time of delivery. How much spanking that baby had I do not know.

In regard to interpartum and postpartum deaths, our series of stillbirths included the interpartum deaths and the antepartum deaths. I presume that really those two topics should be considered together, the stillbirths and the neonatal deaths, but it makes such a vast amount of figures.

In regard to placenta previa, for somewhat over two years, if I recall correctly, we have been doing cesarean section on every case of placenta previa in which we have made the diagnosis.

We have not had a great many cases, but as yet we have not had any fetal or maternal mortality. Several of these cases have been transfused during the operation, some before, and some afterward. We always have a donor ready and the transfusion apparatus set up, and at times we even have the donor by the side of the patient when we are operating. Lately we have been doing the low flap operation on our cases of placenta previa.

DR. MAX D. MAYER (by invitation) read a paper entitled **Psychotherapy and a Gynecologic Service.** (For original article see page 357.)

DISCUSSION

DR. R. T. FRANK.—Before Dr. Mayer's advent in Mount Sinai Hospital we used a great deal of care in eliminating and weeding out patients whose physical disabilities did not seem to fit the type of symptoms that they complained of, with a fair degree of success, but since he has started this work I feel that these patients are benefited in a further way; not only are we safeguarded from doing unnecessary operative work, but these patients when discharged, are taken care of and again made useful individuals.

DR. J. A. CORSCADEN.—The presentation of such a subject before this group is an extremely healthy symptom of the reaction against over-specialization. It is not so long ago that gynecologic results were expressed in mortality. Even now, discussing the treatment of fibroids, I am frequently told that the best treatment is hysterectomy for any fibroid because the mortality can be brought down below one per cent.

In 1914 I had the privilege of working up a follow-up system which was to cover all cases in the hospital. At that time there was no universal follow-up system that I could find in the country. In a few years after this it became apparent (this was for a surgical service) that the results of surgical treatment were not satisfactory. We at first used vague terms to describe the success of our procedures. We soon had to divide the results into three parts, symptomatic, economic, anatomic. We got beautiful repairs, and beautiful excisions without cure of symptoms, or we might cure symptoms, etc., and leave an economically useless person in the community. My own interest in the subject has come particularly because I have induced in many an artificial menopause. In the early days we

were overwhelmed by the numerous symptoms presented by these sufferers. For years we fed them quantities of ovarian extract but without success. About 1917 in desperation we sought relief from the psychiatric field and found that most psychiatrists regarded these symptoms as primarily psychic in origin and not endocrinologic. So, adopting a crude form of psychotherapy, we have reduced the neuroses to at least a comfortable number.

The problem for the gynecologist is to decide how soon he should turn the case over to a psychic expert.

DR. W. H. CARY.—I think this is one of the major phases of gynecologic practice.

I would like to ask Dr. Mayer whether his work was concerned with a group of outdoor or dispensary patients or with a more intelligent group, because it has been a problem to me to know how to devote the time necessary to properly approach these patients' problems.

DR. MAYER (closing).—With Dr. Corscaden I heartily agree that unless a man has had some special interest or training in the subject he is apt to err in the direction of giving advice. The essential feature for us, as gynecologists, is to be able to see that there is a disproportion between the effects and causes and look for a residual phenomenon.

In answer to Dr. Cary I would like to say that this report is based solely upon cases seen in the hospital and the out-patient department, where the work was done for seven years before its being included in the ward. My private experience has not been included in this paper.

I have devoted some time, but I find that the time necessary is not excessive. The special morning clinic has an attendance of less than a dozen cases on the average and outside the regular round hours and in spare hours during the day the cases in the ward are interviewed. I have three assistants who are being trained in the out-patient department to collaborate in this work.

THE OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF MAY 1, 1930

DR. CHAS. C. NORRIS, the retiring President presented an address, after which DR. JOSEPH V. MISSETT described **A Case of Primary Tuberculosis of the Cervix.**

Mrs. F. S., aged fifty-seven years, white, a native of Philadelphia, nullipara, was admitted to the Women's Neurological Department of the Philadelphia Hospital in January, 1930, for the treatment of a left hemiplegia suffered a week before. Other than the paralysis, her complaints were: gnawing pain in the left hip, lower abdominal and lumbar pain of one month's duration, pain in the left shoulder girdle, and vaginal discharge for two months.

She was quite certain of the duration of the discharge, dating its onset following a physical strain. "Felt something rupture after I lifted some tubs, and then the flow began" is her statement. Her family doctor told her her womb was twisted and prescribed a douche, which brought no relief. She was a robust, healthy looking woman, well preserved and whose weight had been well maintained. However, she was extremely neurotic and apprehensive, and examination was rather difficult because she was in fear of being hurt.
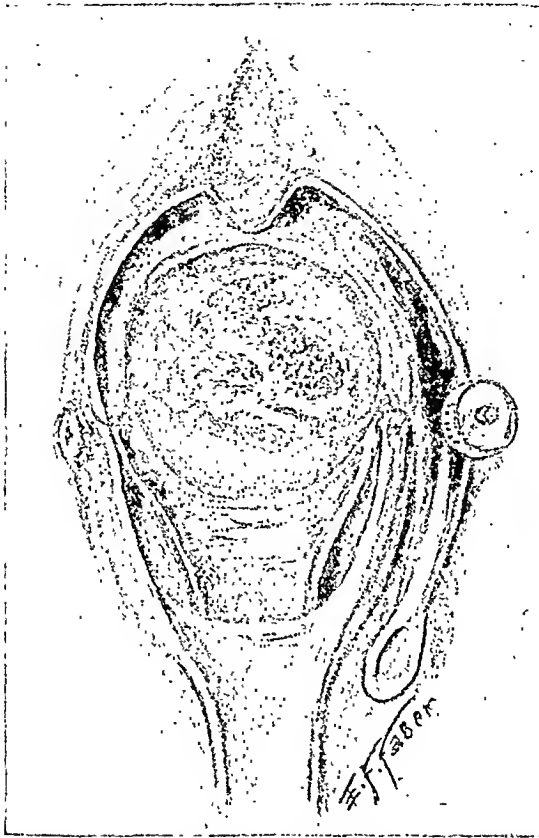
Fig. 1.—Cervix and anterior vaginal mucosa, showing excavating ulceration above anterior lip of cervix, with an area of subepithelial injection to the right of the ulceration. The cervix is atrophic.
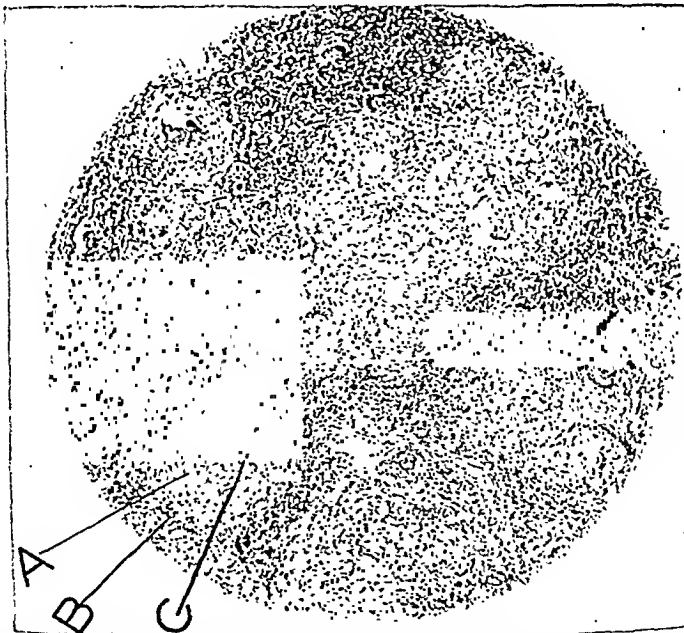
Fig. 2.—Photomicrograph, low power, showing individual and conglomerate tubercle formation. A Represents the center of a tubercle, B the zones of epithelioid and lymphoid cells surrounding the tubercle C a typical Langhans giant cell.

Her past medical history was essentially negative. Her family history was negative, except that her mother died at the age of sixty-three, supposedly of carcinoma of the liver. The patient was married at the age of twenty-four, her marital relations were presumably normal, and her husband was a hard working individual weighing well over 200 pounds. She denied intercourse out of wedlock.

Her menstrual history is unusual. At the time of admission she claimed that at the age of eighteen she had three menstrual periods, spaced at regular intervals of twenty-eight days, with scanty flow for two days and profound dysmenorrhea. There was then a cessation until the age of thirty-eight. Subsequently the patient denied menstruating at the age of eighteen, and stated she menstruated for the first time at the age of thirty-eight. At that age her periods were regular for nine months, menstruating only for a day, however, and with scanty flow; following this she complained of headaches, hot and cold flushes for a long period of time, and profound nervousness.
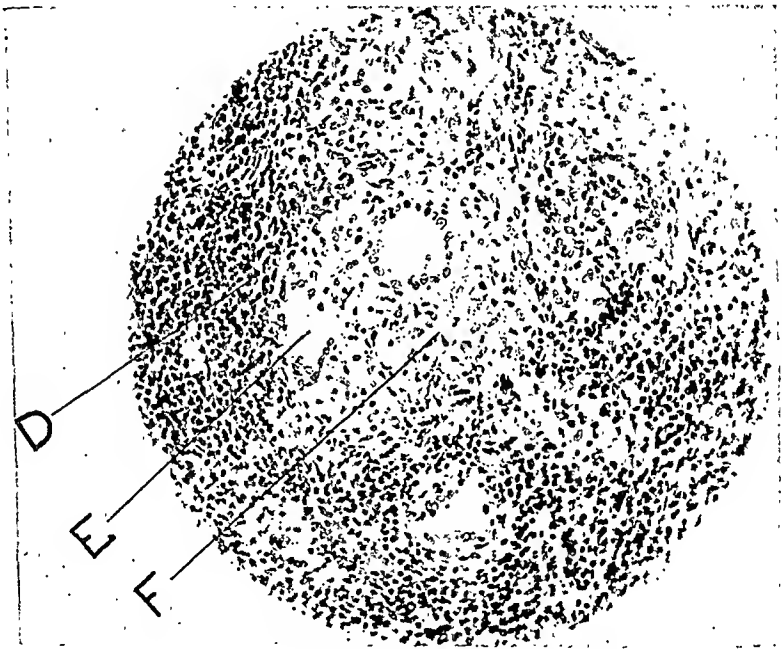
Fig. 3.—Photomicrograph, high power, of tuberculosis nodule in tissue removed for biopsy. *D* Indicates the ring of epithelioid and lymphoid tissue surrounding the tubercle, *E* a typical Langhans giant cell with its peripherally place nuclei, *F* central area of tubercle showing little caseation.

There was no evidence of bone or joint disease, the hip, lumbar area, and left shoulder girdle being ruled out by physical examination and x-ray. Lungs were clear and the x-ray of the chest was negative. There was tenderness throughout the whole abdomen, but it was more apparent than real. The patient could be made to relax and the abdomen could be palpated quite freely. No masses were felt.

A foul smelling, grayish-yellow, purulent, necrotic vaginal discharge was noted. The vaginal mucosa was atrophic or senile. Cervix small, irregular and indurated. Uterus senile or atrophic. No pelvic masses. Unable to feel adnexal abnormality. The tubes and ovaries were considered to be also atrophic. By speculum examination, the cervix was found to be small, with a small closed os. Fairly normal posterior lip. The anterior lip showed what appeared to be an ordinary erosion with excavating ulceration that bled only slightly on vigorous rubbing. Above the actual ulceration was an area of subepithelial injection on the vaginal portion

of the anterior cervix representing an inflammatory extension. The consistency of the cervix was firm. No cysts or granular areas. There was bleeding from the cervix after trauma.

Biopsy report on cervical tissue was as follows: Section shows numerous epithelioid tubercles in which there were many typical Langhans giant cells. There was little caseation. There was no evidence of malignancy.

Diagnosis.—Tuberculosis of cervix.

A second biopsy specimen was taken about two months later and was reported upon as follows: The tuberculous nature of the lesion was not so well demonstrated by this biopsy as by the former. However, the combined picture presented by the sections was entirely convincing.

The further clinical course was, for the most part, an afebrile one. Blood pressure 145/90. Urine examination showed a high specific gravity, trace of albumin and many leucocytes. Blood count was as follows: Hb 12.3 gm., W.B.C. 7000, R.B.C. 4,130,000 and a normal differential count. Blood chemistry was normal. Three special urine examinations revealed no tubercle bacilli.

Comment.—At the present time a final diagnosis of primary tuberculosis of the cervix in this case cannot be made with absolute accuracy. The patient would not submit to surgery as a curative measure, and our diagnosis therefore is based on the physical findings, the microscopic examination of tissue removed from the cervix for biopsy, the absence of associated pelvic pathology, and our failure to discover foci in other parts of the body.

The clinical picture was not wholly unlike that of early carcinoma of the cervix. In fact the tentative diagnosis, before the biopsy findings were reported, was early malignancy. This feature in the case is important, in that it lends further emphasis to the need for microscopic examination of all tissue held pathologically suspicious.

DR. LEONARD C. HAMBLOCK reported and described **Two Cases of Acute Puerperal Uterine Inversion.**

CASE 1.—M. S., primipara, aged twenty-one. The prenatal blood pressure ranged from 90/75 to 100/75. Her only complaint during this time was fatigue. Entered hospital May 20, 1929 with pains every ten to twenty minutes. Membranes unruptured. Rectal examination showed head in pelvis, cervix not entirely effaced, one finger dilatation. Pains not very severe until 6 A.M., when they became more severe and regular at two to three minutes. Cervix three fingers' dilatation and fully effaced. At 10 A.M. she was taken to delivery room with fetal head on perineum. Gas anesthesia begun, membranes ruptured, outlet forceps applied. Episiotomy done and the baby delivered without difficulty. Sutures were placed in perineum, but not tied, no excessive bleeding. When anesthetist stated the pulse at 140, the clinic nurse could not feel the fundus and placenta was presenting itself at the vulva. Anesthesia was stopped and an attempt was made to deliver the placenta. As it was brought through the vulva it was firmly adherent to a pale pear-shaped object, the uterus. Intravenous injection of salt solution begun and while this was running in, the placenta was separated manually and pressure made on the outer margins of the inverted uterus to replace it. The hand followed the fundus as it quickly righted itself, packing was immediately placed in the uterus, heat applied to the body, feet elevated and the pulse watched carefully. Salt solution, 300 c.c., given and the pulse gradually settled down to 110. One hour later patient was put back to bed. Digalen administered hypodermically. In the early evening pulse was 90, and the next morning the packing was removed and sutures in the perineum tied. She made an afebrile convalescence, nursed her baby and was discharged on the fourteenth day.

Examination of this patient on July 26, 1929 showed a well healed perineum, slight unilateral laceration of the cervix, uterus in good position adnexa negative and no tendency to prolapse.

CASE 2.—E. P., primipara, aged forty-one. Prenatal blood pressure varied from 128/90 to 140/80, when she began to complain of slight edema of hands and ankles. Urine at this time showed cloud of albumin and a few hyaline casts. Next examination showed blood pressure of 165/90 with an increase of edema of feet and hands. Since this was definitely a case of toxemia she was admitted to the hospital for induction of labor three weeks before term. Castor oil and quinine were given without results and a surgical induction was done. A Voorhees bag was inserted at 12:10 P.M., March 28, 1930. For two hours no pains and a pound weight was attached to the bag. This caused irregular pains and at 12 midnight the bag had slipped through the cervix. Rectal examination showed a well effaced cervix, no engagement of the head and the cervix dilated three fingers. She was taken to the delivery room, ether anesthesia given, cervix dilated easily manually and version performed. There was no difficulty, forceps were applied on the after-coming head, no suprapubic pressure made, episiotomy was done. Almost as soon as the cord was cut, the placenta was at the vulvae and the patient's pulse had risen to 156. Placenta was delivered with the inverted uterus attached, the placenta separated manually, uterus replaced and packed, hypodermic of 30 c.c. of Digalen given. Since this patient did not present the evident shock as the first patient had done, no further treatment was given. Pulse dropped to 140 and she was transferred to bed. The next morning pulse was 120, temperature 100.2°, blood pressure 120/80. Packing was removed, the patient remained afebrile. Episiotomy was required on seventh day, and the patient left the hospital on the seventeenth day. Examination April 26, 1930 showed a well healed episiotomy, small bilateral laceration of the cervix, uterus well involuted and in good condition. Blood pressure 130/90. Urine, trace of albumin, no casts.

In reviewing our two cases the following interesting points may be noted:

1. The two extremes of childbearing age are represented.

2. The lesser shock in the second patient, due no doubt to the earlier recognition of the condition.

3. Rapid recovering from shock in both cases.

4. Ease of reposition by taxis.

5. Absence of sepsis.

6. Absence of excessive hemorrhage.

7. The first case presented a hypotension during her prenatal term, the second case showed toxemia with hypertension.

8. Inversion followed after two widely different methods of delivery.

DISCUSSION

DR. PHILIP F. WILLIAM.—Although the condition is quite rare I have seen three cases myself. In the first, the woman had been delivered by forceps, sutures had been placed in the perineum but not tied, placenta was manually extracted when the fundus turned inside out. The shock was severe, so the vagina was packed and she was sent to the hospital. I saw her on her arrival, treated her for shock, the examination showed that it was impossible to reduce the inverted fundus by taxis because the cervix was so tightly contracted. She died within an hour after admission.

In the second case, I saw the patient, a primiparous woman, five years ago following a forceps operation. The doctor had done a manual removal of the placenta, which was followed by inversion. There was great hemorrhage and shock. She

was sent to the hospital, given morphia and saline and seemed to rally, and it was decided to attempt reduction by taxis, but this failed and the patient died on the table.

These cases showed what an enormous degree of shock patients suffer after inversion of the uterus.

In the third case I saw the patient only two years ago. It was a primiparous labor delivered by forceps. The placenta was expressed by Credé and immediately the presence of a tumor mass was noted in the vagina, and as this patient was still under the anesthetic, reposition was immediately done, she was packed, had very little shock, and recovered.

I believe it is still true that almost every case of inversion of the uterus is due to some mishandling of the third stage of labor. I heard of one case a few years ago where the placenta remained attached, and the uterus spontaneously inverted following the use of two doses of 1 c.c. each of pituitrin. Since then I have almost invariably had pituitrin given after the completion of the third stage for fear some accident might be caused by over-stimulation in cases where the placenta is still attached.

I think that probably where less haste is made in the third stage of labor less harmful results ensue.

DR. WILLIAM R. NICHOLSON.—I witnessed a case of this kind some years ago, following a careful delivery by forceps. There was no attempt at the Credé method because of lack of time. Inversion of the uterus occurred immediately after delivery. The placenta was removed immediately, reposition done manually, and the patient did well.

Another case was of a woman with a two-thirds inversion, the particular point about this case being while the inversion had been in evidence for some two and a half hours before I saw her, there was no shock and but relatively slight hemorrhage. I told the anesthetist to put the patient under the surgical degree of anesthesia and then simply replaced the uterus by pressure.

I believe deep anesthesia was the important factor in my success in this instance.

In these cases I believe that there must always be a degenerative muscular change in the uterine wall, analogous to what probably occurs in premature placental separation, which permits invagination of a portion of the uterine wall. This invaginated segment then becomes as it were a foreign body in the uterus and under the action of the uterine muscular contractions is progressively pushed out.

With regard to the etiology of inversion, I am perfectly certain that the Credé method has very little, if anything, to do with it; and while of course I do not advocate traction on the cord, I feel that this also has very little to do with it. In other words, as I believe that premature separation of the placenta predicates some disease of the uterine musculature, so do I also believe that the same predisposing factor is operative in cases of inversion. In the two instances of this latter condition which I have seen there was no question of cord traction or forcible manipulation of the uterus in either.

I cannot agree with Dr. Hamblock on the question of pituitrin. Its dangers are the same as that of any powerful drug, if given in an overdose, but as far as these cases are concerned, I am perfectly certain that a dose of pituitrin following the delivery of the baby works against the probability of inversion rather than for it.

One more point I would like to make is that it seems to me that in cases occurring outside hospitals where the possibilities of clean, rapid work are out of the question, that the placenta in cases of inversion had better be left alone, until transfer to hospital can be made. Pack the vagina if necessary because of hemor-

rhage, but as a general rule the immediate removal of the woman to the hospital, with the placenta attached, gives her a better chance than an attempt at reposition in the house.

DR. GEORGE M. BOYD.—The cases I have had of acute inversion of the uterus bear out the viewpoint expressed, namely: the uterus is at fault, for many of these cases are spontaneous. The acute cases have yielded to taxis but I have found it necessary to operate in two. The first was one of complete inversion and failure to reposit the uterus by taxis, it was necessary to do an abdominal section for the purpose of making manual dilatation of the cervix. The second case was one in which the uterus had been inverted for sixteen months. An anterior colpohysterotomy (the Spinelli) was performed with success and it is interesting to know that this woman has had two babies since the operation.

In the treatment of so rare an accident, few have had an extensive experience. This fact probably explains the general hesitancy in the past to accept early operative measures. The operator has often persisted in taxis or the use of some mechanical device or pessary to the detriment of the patient. On the other hand, some operators failing in taxis, recommend hysterectomy for all chronic cases. This operation is indicated where there exists gangrene or marked infection of a tumor of the uterus but in clean cases, it is unjustifiable. In the acute case before involution is completed the uterine musculature is still hypertrophied. It is pliable and will often yield to taxis. Manual reposition should therefore be tried in all such cases but after a month or six weeks the uterus will have returned to its normal size and the tissue become firm and unyielding. In these chronic cases, manual reposition should only be carried out for a short time, if at all. By early operative measures, mortality and the comfort of the patient will be materially improved. Colpohysterotomy is therefore the operation of choice in the treatment of difficult cases. It is conservative, simple of execution and can practically be applied to all. Should the anterior operation fail, the posterior wall of the uterus could also be incised. This would undoubtedly make it possible to reposit the uterus. Anterior colpohysterotomy, the Spinelli operation, has certain advantages over the posterior. The field for operation is more accessible and suturing is facilitated.

DR. GEORGE W. OUTERBRIDGE.—I saw in consultation about a month ago a young primipara, with a complete inversion of the uterus, who had been delivered about five hours before. I believe the placenta had remained attached for about an hour, at the end of which time it was expelled without difficulty by the Credé method. The patient, however, continued to bleed and went into shock. The attending physician made a tentative diagnosis of inversion of the uterus and attempted to replace it but was unsuccessful. The vagina was then packed as firmly as possible around the inverted uterus. When I saw the patient she was in extreme shock and almost completely exsanguinated. Blood was being taken from her husband for a transfusion, and in view of the intense shock, I felt it better to wait until after this had been given before attempting to do anything. The patient received about 450 c.c. of blood. By this time the vaginal packing showed oozing through it, and the patient's condition was slightly, if any, improved. It did not seem justifiable therefore to procrastinate any longer, and I removed the packing and without anesthesia was able comparatively easily, by making pressure on the center of the inversion, to replace it completely. The uterus was then firmly packed, but the patient was in a desperate condition. A second donor was on hand, and blood was obtained from him for a second transfusion, but the patient died before it could be given. I felt that this patient's life could probably have been saved had it been possible to replace the uterine inversion and pack the uterine cavity before so complete exsanguination had taken place. The only possible predisposing condition in this case that I know of, which may or may

not have had any effect, was that about a year previously she had had an incomplete abortion, for which an ordinary dilatation and evacuation of the uterus had been done.

DR. W. E. PARKE.—It is my practice at the Kensington Hospital for women to administer an ampoule of pituitrin as soon as the baby is delivered, and in several thousand cases, no untoward accident has occurred. I believe this practice would oppose rather than favor inversion of the uterus.

DR. P. B. BLAND, DR. L. GOLDSTEIN, AND DR. D. H. WENRICH presented a paper entitled **Trichomonas Vaginalis Vaginitis in Pregnancy.** (For original article see page 365.)

DISCUSSION

DR. P. BROOKE BLAND.—Nearly one hundred years ago (1836) Donne referred to the trichomonas as the possible provocative factor in cases of persistent leucorrhea. Since then more than 60 papers have appeared, both in this country and in Europe, supporting this view.

In order to determine the causative relationship of the parasite to obstinate leucorrhea and especially its possible influence on the normal vaginal flora, and thereby its ultimate relationship to puerperal morbidity, we have systematically examined the vaginal secretion of all patients registering in our Antenatal Clinic.

We have not carried our investigations far enough to express an authoritative opinion with reference to the rôle the parasite may play in puerperal morbidity, but we do believe that it does give rise in some patients, though by no means in all, in whom it is found, to a definite pathologic entity, characterized by minute pinpoint areas of hyperemia and granulation in the cervix and vaginal walls, especially in and about the vault, accompanied by a profuse bubbly discharge.

For a time, I must confess, I was somewhat skeptical as to whether the organism was capable of bringing about pathologic tissue alteration, but substantial proof of its pathogenicity seemingly is found: First, in the numerous papers published dealing with this phase of the problem. Second, because of the fact that it is transmitted from one individual to another; and, third, by the rather characteristic tissue changes which take place in individuals to whom it is transferred.

DR. WILLIAM R. NICHOLSON.—I should like to know whether any pathologic symptoms have ever been found in the mouth as a result of infection with this organism. I should also like to know about the permanence of the suggested culture media, because it would be extremely difficult to carry out this work in a clinic if the culture media was not of a lasting quality. I still doubt whether there is any relationship between this organism and puerperal morbidity.

DR. LEOPOLD GOLDSTEIN.—The organisms are very easily found in the fresh smears of vaginal secretion. They will remain alive for a number of hours or even overnight in an ordinary saline solution; but a little difficulty is encountered in cultivating them.

We are trying to determine the source of these organisms. Later we shall examine the mouths of these patients in order to determine whether there is any relation between the organism found in the mouth and that found in the vagina. As far as its effect on morbidity is concerned, a number of European writers have found that there is a definite relationship between trichomonas infection during pregnancy and morbidity after delivery.

THE OBSTETRICAL SOCIETY OF PHILADELPHIA

STATED MEETING, OCTOBER 2, 1930

Report of the Committee on Pregnancy Toxemia, presented by DR. EDWARD A. SCHUMANN.   (See page 381.)

ABSTRACT OF DISCUSSION

DR. J. O. ARNOLD.—One of the first points in the study and care of toxemia is to properly classify women in pregnancy with reference to the status of the kidney condition.   I have felt, from my own observations, for some years, that there is a definite toxemia of pregnancy, which affects women according to whether they have *now*, or have *had*, any kidney disease; or whether they are *now*, and always have been, *free* from kidney disease.   If we can make that classification from the start, we will have done a great service toward the treatment, or prevention of toxemia.

We must, therefore, have more thorough and efficient methods of study of kidney conditions at the very beginning of pregnancy.   Those cases that show any indication (for instance, by eye, or other examinations) of previous kidney disease, are treated in an entirely different manner from those which are known to be kidney-free at the beginning of pregnancy.

As to the direct treatment of the eclamptics or preeclamptics, it seems to me that one of the greatest advancements that have been recorded recently is that of more careful attention to the ''fluid balance,'' as suggested by the work of Temple Fay.

I agree that most of these patients require very little of the more or less radical treatment we have been giving them.   Very few will require morphia.   Bloodletting, I think, or spinal drainage, will continue for some time, and in some instances magnesium sulphate, or perhaps better, 50 per cent glucose injected intravenously may have beneficial effect.   But for most cases very careful attention to the relationship of intake and output of fluids, and to methods of fluid elimination—keeping the intake *always* several ounces below the output—will undoubtedly prove a most important factor in successful treatment.

DR. JOHN M. LAFFERTY.—The trend of all recent work on eclampsia has tended to show that the cause of this disease will ultimately be found to be due to some disturbance of the maternal metabolism, instigated by the growing fetus. A study of the blood chemistry especially in relation to the various metabolic constituents, will therefore be the key by which this problem will be solved.   The work of a number of investigators, especially the pioneer work of Titus, has demonstrated the fact that the carbohydrate metabolism is especially important, as the fetus is nourished largely by this element in the mother's blood.   One man has the opportunity of seeing comparatively few cases of this disease, and hence a careful study of the blood chemistry of all cases of eclampsia seen by men who have the facilities of a laboratory would supply data of considerable value in clearing up the cause.

I have had the opportunity of collecting blood for examination from six patients in eclampsia, the results of which I am preparing to report at a later date. They all show, I think, a significant fluctuation when taken at five-minute intervals as advised by Titus, and most of them show relatively low average

values. The blood was examined by the method of Folin and Wu which gives a normal variation in blood sugar for 80 to 120 mg.

In all cases there was found a drop of blood sugar preceding the convulsion, followed by a rise after the convulsion.

If this fact is considered in the light of the investigation of the Cori brothers who found that the secretion of the adrenals in a deficiency of oxygen caused the glycogen in the muscles to be incompletely oxidized into lactic acid, which in turn was reconverted into glucose by the liver, it would seem that the convulsions of eclampsia were a protective mechanism of the body to maintain the blood-sugar level. The destructive nature of the convulsion does not mitigate against this view, as other protection reactions, e.g., fever, can be so exaggerated as to destroy instead of conserve.

DR. J. STUART LAWRENCE.—I would like to discuss three aspects of this report.

I. The Method of Investigation.—To establish even a method of investigating the problem of toxemia is difficult. Perhaps another method than that adopted by the Committee might be more successful. In my opinion a better method of procedure would be to have one man from each hospital service, designated by the chief of service, to prepare and report the toxic cases and their incidence according to their own hospital's methods. Each of these men would collect, classify, and analyze their own data from the standpoints of incidence, etiology, classification, and treatment; each of these men to be members of the Committee, together with other men chosen for their special interest in toxemia and especially research workers. Then at the end of a given period and during the period the Committee so composed should be divided into subcommittees by the chairman to collate and analyze and report on the material, methods, and status of the toxic problem. Such a method would perhaps give us a better statement of each hospital's ideas, method, and experience, which would really be the starting point of an investigation.

II. Treatment of Eclampsia.—In order to put myself on record, I wish to say that I employ the conservative method, that is, the Rotunda supplemented by the Titus method.

III. Avoidance of Toxemia.—I believe that the treatment of actual eclampsia cannot go much farther than it has. You will have noticed that one-half of the patients in eclampsia here reported had received prenatal care. Therefore, in the future our course should be to put more and more emphasis on the avoidance of such a result. But toxemia cannot be avoided more thoroughly unless the prenatal clinics become more efficient, and unless toxemia is recognized early. In my opinion this cannot be accomplished if dependence is placed solely on a rise in blood pressure to always give the earliest warning. Although it may be an heretical statement to make, I wish to say that in St. Mary's clinic blood pressures are not determined at all, because it is believed that other ways exist by means of which warning of the approach of toxemia is more certainly and more frequently given. I would illustrate these means by briefly analyzing our experience for the first half of 1928, one of the years embraced in this survey. In the first six months of 1928, the material in the clinic of St. Mary's consisted of 112 cases, which classified by our method consisted of nontoxic 49 cases, mild stage 28 cases, severe stage 35 cases, eclampsia no cases.

DR. THADDEUS L. MONTGOMERY.—From my experiences with toxemia as we meet it among the patients in the Dispensary, I am quite convinced that blood pressure reading and urinary findings do not always forecast some of the most serious cases. In many of the latter, the patient's symptoms and her *appearance*

upon examination is a truer guide of a state of her health than of the developing toxemia. I think we must devote more attention to studies of liver function in these patients. By so doing we will find more definite signs of approaching toxemia than are indicated in the urine or blood pressure.

DR. PHILIP F. WILLIAMS.—My hope that something in the nature of what we have heard this evening might result from the forming of the Committee has been fully justified. It is disappointing to hear of these cases of women reported as dying of toxemia of pregnancy during the two years quoted; and yet how few have been brought to the attention of the Committee.

I regret that one of my services includes one of the cases that was mentioned. This woman's death brings up a sidelight on some of the deaths which occur in convulsive toxemias of pregnancy. This woman had had no prenatal care, was a multipara, thirty-eight years old, and came in with convulsive toxemia. We were able to quiet her with a modified Stroganoff method. She was spontaneously delivered. Her condition, however, did not improve; temperature became high, and after four or five days she died. We hardly felt she had puerperal sepsis, and insisted on an autopsy, which was granted. It was found that the woman had very severe ulcerative colitis. From these ulcers in the colon, ascending transverse and descending colon, streptococci were recovered similar to those recovered from her urine. They were not recovered from blood cultures which were taken.

In the women whose cases we might call low reserve kidney toxemia, or nephritic toxemia, rather than preeclampsia, we have used the technic recommended by Lazard of Los Angeles, using injections of magnesium sulphate intravenously. I am convinced, however, that in a large number of cases as good results can be obtained from rest in bed and from low protein diet. Where the case does not improve, we have speedily resorted to surgical induction of labor.

In two cases which came in my services during the time of this report, I did cesarean section. Both of them were done under a local anesthetic, both recovered, and both babies did well. I am certainly convinced that a mild narcosis and a local anesthetic give a very favorable opportunity for speedily terminating pregnancy where toxemia is present. I have used it on account of the work which Stander has brought out, showing that any type of inhalation anesthesia serves to promote or increase acidosis.

Editorial Comments

The White House Conference*

THE medical service of this important gathering for the study of Child Health and Protection has just held its concluding session in Washington.

The present Conference was called and sponsored by President Hoover, who is deeply interested in child welfare. The Honorable Ray Lyman Wilbur, M.D., Secretary of the Interior, acted as Chairman. The first child welfare conference sponsored by a President was held during the administration of Theodore Roosevelt and another during Woodrow Wilson's administration. Neither of these was in any sense as elaborately planned and carried out as the last, which is the most comprehensive of all.

The purposes of this gathering were to study the present status of the health and well-being of the children of the United States; to report on what is being done for child health and protection; and to recommend what further ought to be done and how to do it.

The comprehensive character of the movement is evident from the direction that it should consider the child from its conception to the eighteenth year of life. Naturally, it would have been undesirable to exclude the mother from consideration, but an attempt was made to regard her welfare only in so far as it affected the fetus, infant, and child.

To the physicians of the country the labors of the Conference are of the greatest interest and importance and a study of the findings of the various Committees when these are published should be carefully read and pondered by everyone engaged in obstetric work.

The Committee on Prenatal and Maternal Care was divided into several subcommittees which studied various aspects of maternal care

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*A later issue of the Journal will be devoted to the publication, of the principal reports presented to the Conference.

in its relation to child health and protection. The statistics of maternal mortality in the United States are not encouraging, and together with fetal and early infant mortality they show little or no decrease in recent years. It is probable that more complete and accurate returns and a better classification of the causes would be of help in determining what should be done in the possible prevention of these deaths.

The Conference brings out again the fact that we have annually in the United States approximately 15,000 maternal deaths, 80,000 deaths of infants under one month and 85,000 stillbirths. It matters little what relative position the United States occupies in the list of civilized countries. The important facts are that we are not improving our rates and that most of these deaths occur from controllable causes. The recent study of the Children's Bureau carried out with the co-operation of State Boards of Health and Medical Societies shows that 40 per cent of the maternal deaths result from sepsis, 26 per cent from toxemia and 11 per cent from hemorrhage. A great majority of these women never had proper prenatal care; inductions of labor were frequent and many had operative deliveries. Live births resulted in only 42 per cent. These studies likewise show that abortions and premature labors were frequent; about 50 per cent of the septic deaths followed termination of pregnancy prior to the seventh month and naturally all of these fetuses died. The stillbirth rate has not changed materially for years and the early infant death rate remains unaltered year after year, while the activity of the pediatricians in stimulating infant welfare work and improving the practice of pediatrics has resulted in a reduction of the later infant death rate. The chief causes of these early infant deaths are prematurity, birth injury, congenital malformations, and infections, including syphilis.

The obstetricians must accept the challenge to correct these conditions. As an individual one can do little, but collectively much could be accomplished. The reports of the committee on Prenatal and Maternal Care brought out much of importance and among other things the shortcomings of education and training in obstetrics were stressed. The training of the undergraduate student in clinical obstetrics was found to be inadequate in many schools. Most schools and states do not require an intern year as a requisite for graduation and the granting of a license to practice obstetrics. The opportunities for the further training of graduates are very meager. Something has been accomplished for the general practitioners by means of the extension and circuit courses which have been given in some of the states. The facilities for the training and teaching of specialists to practice and for positions as teachers and investigators

have been insufficient to meet the needs of the country. There has been gradual improvement in the past few decades, but there is still much to be desired.

The midwives, whose mortality results are in general not higher than those of doctors, have had little opportunity for satisfactory training. It is necessary that they should have facilities for such education if they are to continue in this work. They are needed among the negroes and in certain localities which are sparsely settled, but they should carry on their work under medical supervision and control.

The training of nurses in maternal care has been insufficient and steps must be taken to improve it. The working out of maternal welfare in various communities by a combination of nurse and doctor offers splendid opportunities for success in giving better care to mothers and babies.

In order to secure the best results, it is necessary to have the laity educated to seek and demand adequate attention. The social workers should also be fitted into the scheme and can give valuable aid in helping to solve many family and economic problems related to maternal care.

It is vitally essential in order to secure the necessary results that plans and organizations be developed in each community to furnish every mother competent and consecutive prenatal, intranatal, and postnatal care. The doctors should and must lead in their own communities to secure "for every child full preparation for his birth, his mother receiving prenatal, natal, and postnatal care; and the establishment of such protective measures as will make childbearing safer."

—Fred L. Adair.

Department of Reviews and Abstracts

Selected Abstracts

The Pathologic Puerperium

Young, James: Maternal Mortality from Puerperal Sepsis. British Med. J. No. 3518, p. 967, 1928.

According to the official figures for 1926 the total maternal mortality for England and Wales was 5.14, and the sepsis mortality 1.60, per 1,000 live births.

Septic inflammation of the genital canal during labor or in the puerperium may, as a useful basis for analysis, be considered as falling into one or other of three clinical types according as it is caused by (1) contagion, (2) trauma, or (3) auto-infection.

Autogenous infection is a minor primary cause of fatal puerperal sepsis.

Contagion is probably of comparatively secondary importance. The well established risks of contact infection in hospitals call for care in the extension of the hospital system of maternity service.

There is evidence that trauma is the most important cause of the death rate from sepsis. This is not entirely a problem involving the medical attendant; it has implications of a wider nature.

The immediate need is an improved machinery for maternity practice based on a midwife-doctor combination. From the standpoint of immediate policy the importance of this overshadows all other considerations, for example, "research" and there is reason for the hope that by this means alone a lessening of the death rate is possible.

Improved education of the public, the midwife, and the student, and the assistance of the central and local authority, are all necessary for the creation and working of a satisfactory machine.

PROSHEK.

Hobbs, A. Remington: Puerperal Sepsis. British Med. J. No. 3518, p. 971, 1928.

Conclusions arrived at as the result of the research work carried out at St. Mary Abbots Hospital during the past few years are:

Puerperal sepsis is not by any means invariably accompanied by a rise of temperature. Pyrexia is merely a sign in the course of a septic process, and this is one of the main reasons why a large number of cases of puerperal sepsis are allowed to pass unrecognized through our best maternity hospitals.

Inflammation can be caused by agents other than bacteria. Retained blood and fragments of membranes or placenta will act as foreign bodies and will lead to inflammatory changes in the uterus.

Pain and tenderness must be recognized as the commencement of uterine colic and obstruction. So long as the symptoms and signs of acute uterine colic and obstruction are not added to the list of abdominal inflammations, and are not

treated as soon as they appear, so long will patients be subjected to abdominal explorations, whereas they might have been saved.

It will soon be no longer the fashion for women to bleed for weeks, months, or even years after their confinements, because students will be taught that glycerin will relieve the inflammation which produces the hemorrhage. The best time for treatment is in the early days of the puerperium.

After curetting and swabbing with strong styptics, the uterus must be drained for the succeeding few days.

PROSHEK.

Eden, T. Watts: National Inquiry into the Causes of High Maternal Mortality Rate. British Med. J. No. 3576, 81, 1929.

The National Committee, set up by the Ministry of Health to investigate the causes of maternal mortality in England and Wales, will not be in a position to report for some time, but a similar investigation in the city of Aberdeen, made for the last ten years, has just been completed.

It deals with the following factors influencing maternal mortality; general health of the mother, her surroundings, antenatal supervision, toxemias, hemorrhage, hospital vs. home care, doctor vs. midwife, and puerperal sepsis.

1. General Health. The maternal death rate among unmarried mothers is double the total rate, and mortality from sepsis is presumably much greater than in her married sister. Classifying health as "good," and "unsatisfactory" only 40 per cent of all the mothers who died were classed as having good health.

2. Housing conditions such as overcrowding and deficient cleanliness have no apparent influence in increasing the risks of childbirth. The same may be said of stringency of means.

3. Antenatal Supervision. The death rate among those who received antenatal care was only half the rate among those who did not.

4. Toxemias. Institutional death rate from albuminuria and convulsions among patients over whom these institutions had full control throughout pregnancy was two and a half times as high as the general rate for that condition for the city, the rates being 2.7 and 1.0 per thousand respectively.

5. Hemorrhage. No distinction is made between antepartum and postpartum hemorrhage. Institutional death rate from this cause excluding emergency cases is double the general rate, 1.4 and 0.7 per thousand respectively.

6. The total maternity death rate for the city from all causes over the ten year period was 6.6 per thousand. Death rate in institutions among patients whom they supervised throughout pregnancy, was 14.9 per thousand. The corresponding rate for those attended by private doctors was 6.9 per thousand, by midwives only 2.8 per thousand, by midwives with medical assistance 2.5 per thousand, and by hospital assistants in the district 5.6 per thousand.

7. Sepsis. The general rate for Aberdeen was 1.5 per thousand, about the average for the whole country; the institutional rate, excluding emergency cases, was 4.5 per thousand, in hospital districts only 0.7 per thousand, and among the practice of doctors and midwives well below the average.

A hemolytic streptococcus is the causative organism in all but a small minority of cases. Its natural habitat is the throat. The theory is that this organism is borne from carriers by droplet infection, directly or indirectly, to the genital canal. The possibility that streptococci may make their habitat in the cervical and vaginal secretions during pregnancy, and may become active after labor and invade lacerations or placental site, while admitted, is believed to occur in only a small proportion

of cases. The reason for a higher death rate among cases delivered by doctors than among those delivered by midwives is that doctors are brought more frequently in contact with other diseases of streptococcal origin and are thus more likely to become carriers. The droplet infection theory as the main etiologic factor is by no means proved, and should conclusive evidence in favor of it be adduced in the future, the problem of what to do with these carriers will be an enormous one, as probably the majority of healthy persons are throat carriers of the hemolytic streptococcus, and no mask worn by medical or nursing attendants absolutely prevents droplet distribution.

A striking fact is that in this city most of the deaths from sepsis occurred during epidemics. A single case of acute infection may occur and be spread by gross contagion from one woman to another and also to the infants. This being so, all maternity hospitals should be provided with *isolation blocks* to which all infected cases should be sent as soon as infection becomes manifest, and when feasible an intensive study should be made of those cases by a combined team of obstetricians, bacteriologists and public health authorities.

<div style="text-align:right">GEORGE E. HUDSON.</div>

Peterson, L. S.: Causes of Death in the Puerperium. Acta obst. et gynec. Scandinav. 9: 432, 1930.

Among 24,155 labors there were 165 maternal deaths, or 0.7 per cent. In about 50 per cent of the cases, death was due to infection or toxemia, these two causes being responsible for an almost equal number. Placenta previa was the cause of death in 10 per cent. In many cases of toxemia and placenta previa, death was caused by infection, hence the latter was ultimately responsible for about 40 per cent of all the cases. Five deaths were due to rupture of the uterus and 4 to postpartum hemorrhage. Of the causes not directly associated with pregnancy, pneumonia during the years 1918-20 had a very high incidence. Renal and cardiac disease likewise had a high mortality but very few women with tuberculosis died in the obstetric clinic.

<div style="text-align:right">J. P. GREENHILL.</div>

Jeannin C., and Sureau M.: Statistics of Puerperal Infection. Bull. Soc. d'obst. et de gynéc. 18: 192, 1929.

The authors review a large series of cases treated in various ways. They divide their statistics into several parts, the first of which deals with the general statistics of 12,500 labors. In the second part they analyze the cases received from different sources in an isolation service. They found that among every 1,000 women who give birth, 25 develop puerperal infection. In every 1,000 cases 6 women die, two of whom die of puerperal sepsis. In each 1,000 labor cases there are two cases of periuterine infection, two cases of phlegmasia alba dolens, one of peritonitis and one of septicemia. In each 100 cases of puerperal infection there are 7 cases of periuterine infection, 3 cases of suppurative pelvic phlebitis, 5 cases of peritonitis and 5 cases of septicemia. Out of every 100 deaths from puerperal infection, 5 are due to periuterine infection, 22 to suppurative phlebitis, 38 to peritonitis, 33 to septicemia and 2 to other causes such as embolism and uterine gangrene. The mortality for women with periuterine infection is about 8 per cent, for those with suppurative uteropelvic phlebitis it is 100 per cent for the cases not operated upon and 33 per cent for those on whom an operation is performed. Patients with peritonitis have a mortality of 85 per cent while those with septicemia have a death rate of 77 per cent.

<div style="text-align:right">J. P. GREENHILL.</div>

Gidalewitsch, N. A.: The Puerperium After Plural Births. Monatschr. f. Geburtsh. u. Gynäk. 84: 261, 1930.

The puerperium in cases of plural births is entirely different from that in cases of birth of single children because the former frequently is abnormal. Women who have plural births have febrile complications three times as frequently as those who give birth to single babies. The mortality in the former group is ten times as great as in the latter. There appears to be no difference in premature labors and those at term in women who have multiple births. In these women the frequency of operative deliveries is greater than in the case of single births and the morbidity following these operations is twice as great as in the cases without operative interference. Subinvolution of the uterus is common after plural births.

J. P. GREENHILL.

Claye, A. M.: The Puerperal Morbidity Rate in Patients Delivered Normally. Brit. M. J. 2: 90, 1929.

The writer investigated 1546 consecutive normal cases delivered in the Leeds Maternity Hospital. The object was to determine whether patients examined vaginally had a higher morbidity rate than those not so examined.

The cases are divided into three classes: (1) Morbid, where temperature exceeded 99° on two or more successive days; (2) Submorbid, where the temperature reached 99° or more at least twice during the first 21 days of the puerperium; (3) Normal, where temperature never reached 99° or reached this mark only once in the 21 days. Temperature was taken in the axilla in all cases.

Findings are as follows: (1) *Vaginally examined:* (a) morbid 2.3 per cent, (b) submorbid 6.8 per cent. Total 9.1 per cent.

(2) *Not vaginally examined:* (a) morbid 1.3 per cent, (b) submorbid 5.3 per cent. Total 6.6 per cent.

(3) *Cases with perineal tears:* (a) morbid 2.6 per cent, (b) submorbid 10.9 per cent. Total 13.5 per cent.

(4) *Other operative procedures:* (a) morbid 10.6 per cent, (b) submorbid not given.

Vaginal examinations were done only after the vulva had been shaved and external parts cleaned with 1 to 1,000 biniodide solution. The examiner wore gloves steeped in biniodide solution after being boiled.

The writer would examine vaginally only cases of antepartum hemorrhage where placenta previa is suspected; cases where degree of dilatation of cervix cannot be ascertained by rectum, usually breech presentations; cases where there seems to be something interfering with the normal progress of labor that cannot be determined by rectal and abdominal examination, and finally when operative procedures such as the application of forceps or the extraction of a breech are about to be instituted.

GEORGE E. HUDSON.

White: Puerperal and Abortion Sepsis. Med. J. Australia, 2: 38, 1927.

The paper is based on a study of 70 patients suffering from puerperal and 285 suffering from abortion sepsis. Cultures were obtained from the uterine cavity with an apparatus consisting of an outer glass tube in which was inserted an inner tube, and within this inner tube was placed a woolen swab mounted on a platinum wire. The outer tube was inserted beyond the internal os. The inner tube was then pushed further in and the swab inserted still further to obtain a specimen. The withdrawal took place in the reverse order.

Streptococci were found both within and without the uterus in 45 per cent of the cases, gonococci in 9 per cent, Staphylococcus aureus in two cases, coliform bacilli in two cases and Bacillus Welchii in one case. In two cases gonococci were found inside the uterus but not on the cervix.

In the acute blood infections Streptococcus hemolyticus was almost a constant finding occurring in 85 per cent of cases. The writer feels that nonhemolytic streptococci are commonly present in the genital tract and may cause puerperal sepsis. He feels that this type is undoubtedly an endogenous infection, and that severe puerperal sepsis is mainly caused by hemolytic streptococci which are seldom found in the vaginal flora.

In accounting for this endogenous infection the writer suggests the following methods of contamination: (1) In cases of chronic gonorrhea streptococci often appear as a secondary infection. (2) In multiparae with previous lacerations and erosion of the cervix there is commonly a leucorrhea due to streptococci. (3) Coitus late in pregnancy may be a cause. (4) The mutation of Rosenow in that nonhemolytic streptococci which appear to be a part of the normal vaginal flora may transform under suitable environment into a virulent hemolytic variety.

In considering treatment the writer mentions the use of vaccines, sera, blood transfusions and blood chemical therapy. Under the latter head he describes his technic and results from the use of mercurochrome intravenously and feels that it has given valuable and definite help in septicemia but that it should be used cautiously in cases of nephritis and enterocolitis.

MILLER.

Allan, R. Marshall, and Bryce, Lucy M.: Epidemic of Septic Infection Occurring in a Maternity Hospital. Med. J. Australia 1: 390, 1928.

After the authors had made an investigation for the foci of infection for four septicemia cases in a maternity hospital with one maternal and two infant deaths, they decided a nurse with an infected antrum was the carrier.

The maternal infection became serious on the fourteenth postpartum day, resulting in death on the fifty-fourth day from pyemia. Two babies delivered by different doctors on the forty-sixth and fiftieth days of the maternal infection succumbed. The third baby delivered on the forty-sixth day recovered.

An atypical form of the Streptococcus mucosus was isolated from the mother and from one baby, the only two cases cultured. The only similar organism isolated from all the possible carriers was in the culture taken from an antrum of one nurse.

Following the immediate discharge of this nurse no other patient had infections, and because of this the writers are further convinced of their original findings.

H. C. HESSELTINE.

Robinson, A. L. and Cuttle, G. E.: Infectious Puerperal Fever. Lancet 1: 67, 1930.

Following the appearance of scarlet fever in a puerperal patient 8 mothers and 15 babies developed infections. Among the mothers there were two breast abscesses, two septicemias, three scarlet rashes, and one unexplained pyrexia. In the babies eight scarlet rashes (some typical of scarlet fever), six ophthalmiac infections, and one unexplained pyrexia occurred. One mother and one baby died.

Even though the authors consider many puerperal infections due to direct contact they believe that in this series the source was from air borne organisms. The air borne possibility would explain the less likelihood of infections in the home

because the patient is more isolated. Such a possibility raises the question of admitting visitors to the maternity wards and the using of overalls, face masks, and sterilized linens.

This article intends not to belittle the idea of contact contamination, but to emphasize the possibility of air borne infections which may gain entrance through extragenital routes, as well as to recommend the isolation of all hospitalized infected puerperal patients in adequately accommodated quarters having a special nursing staff.

H. C. HESSELTINE.

Devraigne, Baize, and Mayer: A Few Cases of Puerperal Scarlet Fever Seen in the Lariboisière Maternity Hospital. Bull. Soc. d'obst. et de gynéc. 18: 377, 1929.

The authors report a series of six cases of puerperal scarlet fever which were observed during two epidemics of scarlet fever at the Lariboisière Maternity. One case occurred after abortion and the other five after full-term labor. In none of the cases was angina present, but in all of them there was an infection of the genitalia from the beginning. The authors believe that in these cases the portal of entry was the genital organs and not the throat. One of the authors contracted scarlet fever from one of the patients who did not have angina but he did have typical angina. All but one of the patients were primiparas. It may be difficult to differentiate scarlet fever from puerperal infection but in favor of scarlatina are the following signs: Marked acceleration of the pulse, vomiting, a characteristic eruption and desquamation. The babies were isolated from the mothers as soon as the diagnosis was made but in not a single instance did a baby contract scarlet fever in spite of the fact that in all the cases the babies nursed until the diagnosis was confirmed.

J. P. GREENHILL.

Brügelmann, C.: Observations on Puerperal Sepsis Especially Concerning the Localization and Frequency of Metastases. Monatschr. f. Geburtsh. u. Gynäk. 76: 404, 1927.

The author studied 300 cases of puerperal sepsis of which 251 followed abortion, and 49 labor. The mortality for this series was 75 per cent, and in 75 per cent of all the cases metastases were present. Sixty per cent of the patients had thrombophlebitis and the mortality for these patients was 70 per cent. There was an average of 1 to 2 metastases per case and these occurred most frequently in the lungs, less frequently in kidneys, skin, musculature, joints and spleen and least of all in the meninges, myocardium, liver, bones, glands, brain, etc. The most frequent organism causing metastases was the anaerobic Streptococcus putrifieus. Half as frequent as the latter were the hemolytic streptococcus and mixed infections. In 10 per cent of the cases lymphangitis was present and the mortality for these cases was 50 per cent. Metastases were less frequent than in the thrombophlebitis cases and these were especially localized in the joints. The most common organism found was the hemolytic streptococcus. Endocarditis was present in 12 per cent of the cases and all the patients died. The average number of metastases per patient was 3 and these occurred most frequently in the kidneys, caused most often by the aerobic streptococcus and less frequently the hemolytic streptococcus. In 15 per cent of the cases there were mixed forms such as thrombophlebitis plus lymphangitis, lymphangitis plus endocarditis and abscesses in many organs. Here the mortality was 85 per cent. Most of the metastases occurred in lungs, kidneys, and skin.

J. P. GREENHILL.

Burger, P.: Joint Metastasis in Puerperal Infection. Gynécologie 26: 331, 1927.

Burger disusses nine cases of joint metastases in puerperal fever. The condition is relatively uncommon. The joints affected are usually the elbow, shoulder, knee and foot, in order named, and the primary lesion is an embolus, arterial or capillary, in the periarticular tissue, or even in the bone near the joint. The condition is not necessarily due to a septic thrombus and may take place in the course of an ordinary septicemia. It represents a serious factor in the prognosis. Four cases developed as a result of definite septicemia, the others during the course of combined pyemia and septicemia. All nine patients died. One case of particular interest was an infection, antepartum in origin, a septicemia as a result of laryngo-pharyngitis with subsequent pyemia after involvement of the puerperal uterus. Streptococcus septicemia is the most important cause and the prognosis is extremely grave. The complication usually occurs early in the course of the disease.

<div align="right">LITTLE.</div>

Saenger, Hans: Puerperal Gangrene in Septic Conditions and Gynergen Medication. Zentralbl. f. Gynäk. 53: 586, 1929.

Saenger from an analysis of the literature finds that most of the so-called cases of gangrene following treatment with gynergen and other ergot preparations have had puerperal infections, or vasomotor diseases of various kinds. In only two of the cases analyzed was the dosage greater than normal. In the noninfected animal enormous doses of ergotamin are required to produce gangrene, and the question is raised if ergotamin is the typical vasoconstrictor that it has been held to be. The author believes that without septic infection or neurospastic predisposition, puerperal gangrene will not appear. He believes atony of the uterus postpartum is the chief indication for the use of the drug, and emphasizes that with the first appearance of prodromal symptoms the drug must be stopped.

<div align="right">WILLIAM F. MENGERT.</div>

Weinzierl, E.: Total Gangrene of the Puerperal Uterus. Arch. f. Gynäk. 130: 324, 1927.

The author reports the case of a twenty-one year old primipara, who, on the seventeenth day of a septic puerperium, developed symptoms of diffuse and acute pelvic peritonitis. Laparotomy revealed a totally gangrenous uterus which had completely detached itself from the uterine ligaments and supports, and was lying as a definitely separated sequestrum in a serous sac. This had ruptured and just beneath the defect there was a hole in the uterus. Death occurred on the third day following laparotomy. This entire picture followed a long hard labor which was terminated by a forceps delivery. There had been an early rupture of the uterus followed by the use of oxytoxics to stimulate labor pains. The author is of the opinion that if the rupture of the uterus had not occurred, the sequestrated uterus might have been spontaneously expelled with a recovery of the patient.

<div align="right">RALPH A. REIS.</div>

Schumacher, P.: Causes of Post-Operative and Puerperal Thrombosis and Embolism. Arch. f. Gynäk. 129: 929, 1927.

Cardiovascular disturbances, adiposity, and postoperative pulmonary disease and other conditions favoring a slowing of the circulation were found in 53 per cent of the cases which developed thrombosis of the legs and in over 70 per cent of the cases which developed embolism. Vaginal operations are especially prone to be followed by embolism. Manual separation of the placenta and tamponade of the

uterus also predispose towards embolism and thrombosis. Infection is a factor in 55 per cent. Those patients who are kept in bed longer than normal for any reason are especially apt to develop embolism and thrombosis because of the prolonged circulatory retardation. Postoperative and puerperal patients should be gotten up, therefore, as early as is possible.

RALPH A. REIS.

Beck, H.: Puerperal Endometritis Following a Retrograde Infection Through a Venous Thrombosis. Arch. f. Gynäk. 131: 701, 1928.

The patient was a primipara, who three days after a normal and spontaneous delivery, developed high fever and chills. The following day she had an eclamptic convulsion and died. Autopsy showed a chronic phlebitis of the right ovarian vein which from gross and microscopic appearances apparently dated from early pregnancy. There was a thrombus present at the junction of the ovarian and renal veins which was also of long standing. Following the delivery, this latter increased in size due to the slowing of the circulatory stream, and the infection flared up. The streptococci present in the thrombus became more virulent and, due to the reversal or cessation of the blood stream through this vein, were able to pass backwards, reach the uterus, and set up an acute endometritis.

RALPH A. REIS.

Chalier, J. and Rousset, J.: Puerperal Tetanus. Progrès méd. 43: 565, 1928.

Postpartum tetanus has practically disappeared and we meet now only with postabortal tetanus, most often following criminal abortion. Placental retention favors the development of tetanus, and it may occur in association with other infections which serve to mask the actual picture. Occasionally, however, it occurs quite by itself. In postmortem specimens tetanus bacilli may be found in sections of the affected tissue. The period of incubation varies like in nonpuerperal tetanus. The cases with short incubation are usually overwhelming and early fatal. Spasm and contracture of the muscles in the region of the anterior abdominal wall and in the lumbosacral region and lower limbs are rather characteristic. Acute and chronic forms are noted, the chronic form being the least frequent. The only cases with favorable outcome have been among the chronic cases. The mortality rate in the acute cases is probably around 90 per cent. Serotheraphy as ordinarily advised, but with larger doses and especially by the intravenous route should be used.

GOODRICH C. SCHAUFFLER.

Woden: What Procedure Should be Adopted for Retention of Products of Conception? Bruxelles méd. 8: 108, 1927.

On the fifth day postpartum the uterine cavity is invaded by bacteria from the vagina. In 38 per cent of cases streptococci are present. Vicarelli has shown that the addition of placental extract to a bacterial culture greatly enhances growth. Again Warnekros has proved that when the uteroplacental circulation remains intact, organisms of the placental zone penetrate directly into the veins and lymphatics of the uterine wall and thence into the maternal circulation. Thus retained secundines contribute greatly toward the development of a puerperal infection. For this reason the after-birth should be carefully examined for missing cotyledons, succenturiate lobes or incomplete expulsion of membranes.

When little tissue is retained Woden advocates pituitrin or ergot for the first three days postpartum. By this method the retained membranes are usually expelled on the third day. However, in cases where the retention persists and the temperature is not over 38 or 38.5° C., a curettage should be done. The third to fifth day

postpartum is the most advantageous time to carry out this procedure as the uterus is somewhat contracted and more firm, yet the bacterial invasion from the vagina has not occurred. However, where the temperature has risen above 38.5° C., expectant treatment should be continued.

In all operative deliveries showing evidence of retained cotyledons an immediate manual removal of the retained tissue is advocated by the author. Because the cervix is already dilated for a curettage on third day no anesthesia is necessary. A dull curet is used, and curettage is preceded and followed by a sterile intra-uterine douche. THEODORE W. ADAMS.

Ryberg, C. M.: Some Experiences Concerning Placental Fragments at Parturition. Acta obst. et gynec. Scandinav. 6: 153, 1927.

During the last twenty-five years there were 45 cases of retention of placental tissue after labor at the Lund Clinic. Of this number 28 were delivered in the clinic and 17 were sent to the hospital because of this complication. The incidence of this complication in the hospital was 0.13 per cent.

The most striking thing about the study of the placenta after its expulsion is the difficulty of deciding definitely whether or not a piece of placental tissue has been retained in the uterus. Thus among 64 cases where a note was made after examination of the placenta that placental tissue was retained in the uterus, this notation was found to be correct in only 20 per cent. On the other hand, among the 28 patients delivered at the clinic, the retention was not suspected in 13 instances (46 per cent). In 22 per cent of all the cases the placenta had been removed manually or had been expressed by the Credé maneuver, and in 78 per cent it had been expelled spontaneously.

The most important symptom of placental retention was hemorrhage and this occurred in 47 per cent of the cases. In 55 per cent of the cases, the bleeding began during the first week postpartum, in 36 per cent during the second and third weeks, and in 9 per cent between the thirty-first and sixtieth days. In most cases the bleeding was moderate in amount. The next most prominent symptom was fever, in 70 per cent of the cases. In all the cases but one it began during the first week after labor. The fever disappeared in most of the cases where the placental tissue was expelled spontaneously. The latter occurred in half of the patients delivered in the clinic, but among the 17 sent to the hospital after delivery, only two patients expelled the tissue spontaneously. Not one of the patients who passed the tissue spontaneously died. The total number of deaths was seven (15.6 per cent). The author concludes that where there is only a suspicion of partial placental retention, it is best to wait, but where it is certain that placental tissue has been retained, it is better to remove the retained fragments as soon, as completely and as gently as possible. J. P. GREENHILL.

Balard, P.: Late Hemorrhages in the Postpartum Period. Clinical and Therapeutic Study Based Upon 50 Bordeaux Cases. Bull. Soc. d'obst. et de gynéc. 5: 362, 1930.

Some time ago Couvelaire called attention to hemorrhages which occur in the puerperium and which are not due to retention of placental tissue. The cause in these cases is a severe puerperal infection and Couvelaire advocated radical treatment by hysterectomy. Balard collected 50 cases of late puerperal hemorrhages which occurred in the Bordeaux clinic. The mortality was between 20 and 25 per cent hence the condition is very serious. In 26 cases there was placental retention but in 24 cases there was none. In the latter cases severe puerperal infection was present. Fever occurred in 45 per cent of the cases with placental remains and in 30 per cent of those without placental tissue retention. In both types the uterus was large, soft and tender; in both the time of appearance of the

hemorrhage, of the intensity and recurrence was the same. However, in favor of a diagnosis of placental retention are the following facts: These cases are more frequently preceded by an operative delivery. They occur from the eighth to the fifteenth day after delivery whereas the cases without retention usually occur between the seventh and twelfth day. The lochia are frequently purulent and malodorous and the patients complain of pain in the uterus. To make the diagnosis certain it is necessary to do an intrauterine examination under aseptic precautions.

Among the 26 cases with placental retention 5 died. All the cases were treated by curage, curettement or tamponade and no hysterectomy was performed. Among the 24 cases without retention 4 died. Among those cured, 9 were treated on purely medical lines, 13 by curage, curettement or tamponade and 2 by hysterectomy. Of the 4 fatal cases, two had had a hysterectomy.

The author strongly advises against tamponade because in 5 of the 9 fatal cases it was employed. It favors retention of the lochia and therefore infection. If a tamponade has been used, the author urges that hysterectomy be performed.

For cases with placental retention the author advocates only digital curage. If however, the hemorrhage recurs and if fever is present, hysterectomy should be performed and not more than twenty-four or thirty-six hours should be permitted to elapse.

In the cases of hemorrhage without placental retention medical therapy should be used for the mild cases. This consists of hot vaginal douches, sometimes intrauterine douches, ergot, pituitrin, ice and anti-infection treatment such as sulpharsenol, fixation abscess and transfusion. Hysterectomy should be reserved for the grave cases but one should not delay too long before the operation is done.

<div align="right">J. P. GREENHILL.</div>

Fraenkel, O.: Late Postpartum and Postabortal Hemorrhage. Arch. f. Gynäk. 129: 87, 1927.

Fraenkel does not believe that all cases of delayed postpartum or postabortal hemorrhage are due to the retention of some of the products of conception. He reports a series of 460 such cases of delayed bleeding. Many of these hemorrhages are due to faulty or incomplete involution of the decidua and more especially of the uterine blood vessels. He proves this by sections made from uterine scrapings and from uteri which were removed on account of such delayed and excessive bleeding.

<div align="right">RALPH A. REIS.</div>

Original Communications

STUDIES ON UTERINE HEMORRHAGE

RELATION OF THE HEMORRHAGE TO THE EVENTS OF THE MENSTRUAL
CYCLE AND TO THE PATHOLOGIC FINDINGS

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OF PRIMARY importance in any consideration of abnormal uterine hemorrhage is the relationship between the pathologic bleeding and the so-called normal blood loss accompanying menstruation. Although the commonly accepted terms "menorrhagia" and "metrorrhagia" may be sufficient for clinical purposes, they are incomplete, since they fail to describe certain pathologic variations of physiologic processes which occur in many instances and thus give no clue as to etiology or treatment. In the present study a detailed analysis of the clinical histories of a large series of patients with abnormal uterine bleeding has been made in order to establish a correlation between the hemorrhage, the sequence of events accompanying the menstrual cycle, and the pathologic findings in the pelvic organs.

All cases of abnormal uterine bleeding, as suggested by Cullen, may be divided into two main groups, namely, (1) hemorrhages associated with pregnancy, and (2) hemorrhages in nonpregnant conditions. Of 1137 consecutive cases available for this study, it was found that 630 belonged to the first category and fell into six main pathologic groups. There were 502 cases of abortions or postabortum complications, 51 of tubal gestation, 38 of placenta previa, 33 of severe postpartum bleeding, and 6 of hydatidiform mole.

This report, however, is concerned with hemorrhage in nonpregnant conditions and is based on a study of 507 cases. In all instances a complete menstrual history with detailed information as to the character of the abnormal bleeding was available.* It was also essential to have a reliable pathologic report, and since almost all the patients were subjected to some operation it was possible to examine microscopic sections in nearly every instance. It was felt that in the absence of any recognizable pathologic condition no case should be considered unless a satisfactory specimen of at least the endometrium had been obtained.

An analysis of the details of the uterine bleeding showed that the patients could be grouped into eight definite categories:

1. Patients with a regular twenty-eight- or thirty-day cycle, but with a profuse or prolonged flow (menorrhagia) (99 cases).

2. Menses occurring at irregular times: (a) Too frequent menses, that is, with shortened intervals (59) cases); (b) delayed menses, that is, with intervals longer than twenty-eight days (2 cases); and (c) totally irregular intervals (10 cases).

3. A group with continuous bleeding which sets in following a previously normal cycle, and the onset occurs (a) at the time of menstruation (42 cases); (b) during
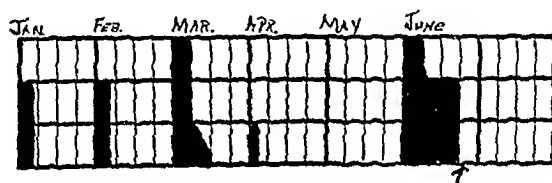
Fig. 1.—Diagram illustrating the use of Schroeder's graph depicting uterine hemorrhage. The width of each column indicates the duration of flow, the space between each vertical line being equivalent to one week; the height of the column shows the amount of bleeding (scanty, moderate, or profuse).

The above example is interpreted as follows:

In January and February the patient had a menstrual period of moderate intensity and lasting five days; in March she had a profuse flow for one week and then scanty for another week; in April she had scanty bleeding for three days. She then had an eight weeks' period of amenorrhea followed by one week of profuse and two weeks of moderate bleeding. She was admitted to the hospital at this time.

the stage of proliferation (tenth to eighteenth days of the cycle) (17 cases); and (c) during the stage of secretion (premenstrual phase) (3 cases).

4. Patients with a short period of bleeding at about the time of ovulation (tenth to eighteenth days of the cycle) (4 cases).

5. Patients with menorrhagia or irregular menses which become progressively worse each month and the condition eventually ends in atypical and irregular or continuous bleeding (9 cases).

6. Continuous bleeding following a period of amenorrhea of at least six weeks' duration and eliminating all possibility of pregnancy (15 cases).

7. Patients with atypical irregular bleeding having no definite relation to the menstrual cycle (157 cases).

8. Bleeding following the menopause (90 cases).

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*The importance of careful history-taking in patients with uterine bleeding cannot be overestimated, not only as a guide to diagnosis and therapy, but also as an aid to scientific investigation. This information should include all details relative to the menstrual periods at different ages as well as data regarding the immediate complaint. The use of a simple graphic method giving the recent menstrual history and occurrence of abnormal uterine bleeding is of great assistance and we have found R. Schroeder's graph very satisfactory for this purpose (Fig. 1). Rubber stamps of this diagram may be made and used in any desired page of the case report.

1. TWENTY-EIGHT DAY CYCLE; MENORRHAGIA

The first group is one of the largest and is made up of patients with profuse or prolonged menstrual periods. The length of the menses varied from seven days to three weeks, and the total duration of the symptoms from two months to fifteen years. The loss of blood was of sufficient severity to produce a secondary anemia in 15 instances, 11 of whom had fibromyomas. Ninety-nine women were in this category, and the pathologic diagnoses showed the following distribution:

Fibromyomas of the uterus	29
Pelvic inflammatory disease	21
No pathology found	12
Uterine displacements	10
Hyperplasia of the endometrium	8
Subinvolution of the uterus	8
Fibromyomas of the uterus plus pelvic inflammatory disease	3
Endometritis	2
Fibromyomas plus polyp of the endometrium	2
Polyp of the endometrium	1
Hypoplasia of the uterus	1
Polyp of the uterine cervix	1
Constitutional factors	1
Total	99

Thirty-two of the patients in this group were over the age of forty (fibromyomas 15, fibromyomas plus pelvic inflammatory disease 1, pelvic inflammatory disease 3, endometritis 1, subinvolution of the uterus 2, hyperplasia of the endometrium 3, endometrial polyps 3, uterine displacements 2, and no pathology found 2). Twenty-six of the patients had had no pregnancies, and of these 10 were found to have fibromyomas of the uterus. The most common type of fibromyoma was the intramural, which occurred in 24 of the cases, while the submucous was found in 6 instances. The histologic study of the endometrium in the 29 cases with fibromyomas of the uterus showed the following: normal endometrium 19, atrophy 4, hyperemia 2, and no specimen available 4.

Although many diseases may lead to menorrhagia, an analysis of these findings shows that the two main factors responsible for profuse periods with a twenty-eight day cycle are conditions which either interfere with the normal contractions of the uterus or which result in a hyperemia of the pelvic organs (fibromyomas of the uterus, pelvic inflammatory disease, subinvolution of the uterus, and uterine displacements). A primary endometrial lesion as the etiologic factor for the bleeding occurred only in a small number of cases. The 8 patients with hyperplasia of the endometrium must be considered as a separate group since there is here an endocrine disorder with ovarian changes in addition to the endometrial disturbance. In 12 instances no gross pathologic lesion could be found to account for the menstrual hemor-

rhages and a diagnostic curettage showed a normal endometrium. The fact that only one (a case of hemophilia) was found in the group "constitutional factors" is due to the system of classification in use in this institution, all such cases having been under the care of another department and thus not appearing in the files of the Gynecological Division. It is well recognized, however, that conditions such as cardiac disease, hypothyroidism, etc., are of considerable importance in any consideration of menorrhagia.

2. IRREGULAR MENSES

In the second category are found women who complained that their menstrual periods occurred at intervals other than the twenty-eight-day type, and they were subdivided so as to define more accurately the type of irregularity noted. (A) The first subgroup included patients whose menses appeared at shortened intervals (every two to three weeks) and 34 of the 59 in addition had a profuse or prolonged flow; (B) patients with prolonged intervals between periods (2 cases); and (C) totally irregular periods, the interval being sometimes shortened and sometimes lengthened (10 cases). The pathologic findings were found to be as follows:

	A	B	C
Pelvic inflammatory disease	14	0	3
Fibromyomas of the uterus	9	0	1
No pathology found	9	1	3
Uterine displacements	8	0	0
Fibromyomas of the uterus plus pelvic inflammatory disease	4	0	0
Hyperplasia of the endometrium	4	0	2
Polyp of the endometrium	3	0	0
Constitutional factors	3	0	0
Adenomyoma of the uterus	2	0	0
Fibromyomas plus polyp of the endometrium	1	0	0
Endometritis	1	0	0
Bilateral teratoma of the ovary	1	0	0
Polyp of the uterine cervix	0	1	0
Hypoplasia of the uterus	0	0	0
Total	59	2	10

In menstrual irregularities of this type it is essential to seek the causal factor in functional disturbances of the ovaries. An analysis of the pathologic findings shows that this is due in many instances to gross anatomic lesions which may also be accompanied by vascular changes. In the first place is found an *active hyperemia* of the ovaries induced by the periooöphoritis incident to pelvic inflammatory disease or accompanying some cases of fibromyomas of the uterus. Second, a *passive hyperemia* may be found with displacements of the uterus due either to an anatomic interference with blood supply or accompanying an asthenic condition of the individual. The association of retroversion of the uterus and frequent menses has been observed by a number of

other authors, and an analysis of 144 cases of uncomplicated retroversion from the Stanford service (MacKinnon) showed that menstrual periods with shortened intervals occurred in 11.8 per cent of the cases, with lengthened intervals in 4.8 per cent, and with totally irregular intervals in 4.2 per cent.

In many instances of irregular menses there is a primary endocrine dysfunction. This may be the explanation for the irregular periods in many of the patients with fibromyomas of the uterus, since 7 of the 10 in this group were women over forty years of age, and it is thus probable that a menopausal endocrine disturbance is the more important feature. From this standpoint one would expect to find more than 8 patients with no gross pelvic pathology, but nevertheless this number represents a higher percentage than in any other group, and it must be remembered that only women who had had a diagnostic curettage were included. Since it is not our practice to resort to the curette merely for menstrual irregularities a large number of cases were necessarily eliminated from the series, and this is also the explanation for the fact that only 2 patients with lengthened intervals were available.

3. REGULAR CYCLE, THEN CONTINUOUS BLEEDING

The third group is of special interest in that it represents a very close connection between menstruation and abnormal bleeding. In the first place, are found 42 cases where bleeding set in with menstruation and continued for from two to four weeks:

Hyperplasia endometrii	11
Pelvic inflammatory disease	6
Carcinoma of the cervix of the uterus	5
Fibromyomas of the uterus	4
No pathology found	3
Adenomyoma of the uterus	2
Endometritis	2
Uterine displacements	2
Polyp of the endometrium plus pelvic inflammatory disease	2
Polyp of the endometrium plus fibromyomas	1
Teratoma of the ovary	1
Polyp cervix of the uterus	1
Fibromyomas plus pelvic inflammatory disease	1
Polyp of the endometrium	1
Total	42

In many of the cases of this group are found lesions intimately connected with the endometrium, and it would thus seem that one of the main factors for this type of bleeding is an interference with the tissue repair following desquamation. This is shown by the occurrence of (a) definite pathologic lesions such as hyperplasia of the endometrium and endometritis, and (b) a mechanical irritation of the endometrium,

demonstrated by 4 cases of endometrial polyps and the fact that in every case of fibromyomas in this group, at least, one tumor was of the submucous variety. It is likely that in other conditions such as cancer of the cervix an important factor is the hyperemia of the uterus accompanying menstruation.

The second subgroup (17 cases) is made up of women with uterine bleeding which sets in between the tenth and eighteenth days of the cycle:

Pelvic inflammatory disease	12
Hyperplasia of the endometrium	2
Fibromyomas of the uterus	1
Fibromyomas of the uteri plus polyp of the endometrium	1
Erosion of the cervix of the uterus	1
Total	17

The figures show very clearly that an overwhelmingly large percentage of patients with this type of bleeding have a pelvic inflammatory disease, and the explanation must be found in an ovarian infection which causes a destruction of the developing corpus luteum and thus an early appearance of "menstruation." In 4 of the cases the ovarian infection could be demonstrated histologically. The experiment of Fraenkel who produced uterine bleeding by cauterization of the corpus luteum, and which has been performed many times since by gynecologists, thus affords the physiologic basis for this type of hemorrhage.

Only three cases were found in which bleeding set in during the premenstrual period, namely, one with an erosion of the cervix, another with a mucous polyp of the cervix, and one with a retroversion of the uterus. It is scarcely conceivable that we are dealing in these cases with any alteration in the course of menstruation, but it is likely that the premenstrual hyperemia of the pelvic organs offers an important contributory factor.

4. OVULATION BLEEDING

The occurrence of uterine bleeding in the middle of the menstrual cycle at the time rupture of the follicle takes place has long been recognized. In this group have been included women who stated that they had a slight sanguineous discharge about one week after the termination of the regular menstrual period and lasting for from two to three days. One of these patients had a subserous myoma which probably had nothing to do with the bleeding; a second showed no gross pathology and the endometrium was normal; another had an endometritis; while the fourth had an extensive pelvic inflammatory disease with involvement of both tubes and ovaries. It is probable that many patients included in Group 2 who complained that their menses occurred

every two weeks also belong to this group of "ovulation bleeding," and evidence for this was advanced in a previous communication.

5. PROGRESSIVE MENORRHAGIA SUCCEEDED BY CONTINUOUS BLEEDING

The fifth group of the series is a small one (9 cases) and is made up mainly of patients with a hyperplasia of the endometrium (5 cases). The clinical history shows very clearly a lesion which gradually progresses over a period of from five months to four years. The patients first notice that their menstrual periods become more profuse or occur at shortened intervals, and this becomes intensified each month until finally the bleeding is continuous. Besides the cases of hyperplasia of the endometrium, this type of history was also obtained from two patients with carcinoma of the cervix uteri, one with a submucous fibromyoma, and one with a fibromyoma plus pelvic inflammatory disease.

6. CONTINUOUS BLEEDING FOLLOWING A PERIOD OF AMENORRHEA

The sixth group presents a series of patients of the childbearing age who complain of uterine bleeding which sets in following a period of amenorrhea unassociated with pregnancy. Fifteen patients were found with this type of hemorrhage, and with the exception of one patient they could be classed into two definite groups. The most important was composed of women with hyperplasia of the endometrium and accounted for 12 of the cases. The period of amenorrhea as a rule varied from six weeks to three months, but in two instances it lasted for as long as seven months and two years respectively.

The second group was of less significance since only two patients were found (fibromyoma of the uterus, carcinoma of the cervix of the uterus). It is characterized by the occurrence of a traumatic or ulcerative lesion in patients who have had amenorrhea due to a previous destruction of the ovaries by radiation or removal by operation.

Only one patient, with a retroversion of the uterus, did not fall into either of the above categories. The diagnostic curettage revealed a normal endometrium with a well-developed stage of secretion, and thus suggests the possibility of amenorrhea due to a corpus luteum persistens.

7. ATYPICAL IRREGULAR BLEEDING

The seventh group is the largest numerically and is made up almost entirely of women of the childbearing age with lesions producing hemorrhage as a result of trauma or ulceration of the cervix or endometrium, so that it has no relation to the events of the menstrual cycle. The pathologic diagnoses of the 157 cases are as follows:

Carcinoma of the cervix of the uterus	61
Fibromyomas of the uterus	17
Hyperplasia of the endometrium	17
Pelvic inflammatory disease	13
Erosion of the cervix uteri	8
Polyp of the endometrium	7
No pathology found	7
Polyp of the cervix of the uterus	6
Carcinoma of the fundus of the uterus	5
Uterine displacements	4
Constitutional factors	3
Subinvolution of the uterus	2
Fibromyomas plus pelvic inflammatory disease	2
Fibromyomas plus polyp of the endometrium	2
Pelvic inflammatory disease plus polyps of the endometrium and cervix of the uterus	1
Hyperemia of the endometrium	1
Carcinoma of the ovary	1
Total	157

8. POSTCLIMACTERIC BLEEDING

Ninety patients who had passed the climacteric complained of irregular uterine bleeding. As in Group 7 one must look for traumatic or ulcerative lesions in the majority of instances, and it is of importance to note the preponderance of malignant disease. A rare condition which must also be kept in mind is the occurrence of hyperplasia of the endometrium accompanying ovarian newgrowths. The conditions found are as follows:

Carcinoma of cervix of uterus	60
Carcinoma of the fundus of the uterus	8
Polyp of the cervix of the uterus	4
Erosion of the cervix of the uterus	3
Prolapse of the uterus (with erosion of the cervix of the uterus)	3
Fibromyomas of the uterus (submucous)	3
No pathology found	3
Polyp of the endometrium	2
Pelvic inflammatory disease	1
Newgrowth ovary (with hyperplasia of the endometrium)	1
Constitutional factors	1
Fibromyomas of the uterus plus pelvic inflammatory disease	1
Total	90

SUMMARY

An analysis of 1137 cases of abnormal uterine bleeding showed that 630 were associated with pregnancy, while 507 cases were in nonpregnant women. The latter patients were classified into 8 distinct categories according to the clinical manifestation of the hemorrhage.

1. Menorrhagia, or profuse or prolonged flow in patients with otherwise normal menses. The sequence of events of the menstrual cycle in the ovaries and endometrium is undisturbed. The most frequent

etiologic factor is any condition which interferes with the contractile power of the uterus or results in a hyperemia of the pelvic organs.

2. There is an irregularity in the time factor, the menstrual periods appearing too frequently, or are delayed, or are totally irregular in their occurrence. The main etiologic factor is to be sought in disturbances of ovarian function, which may be of a primary endocrine nature or secondary due to anatomic lesions.

3. (a) Hemorrhage initiated with a menstrual period may continue for a prolonged length of time. In these cases are mainly found lesions intimately connected with the endometrium, such as submucous fibromyomas and endometrial polyps, or definite pathologic changes such as hyperplasia of the endometrium or endometritis.

(b) Continuous bleeding may set in during the stage of endometrial proliferation. The physiologic explanation may be found in a sudden destruction of the corpus luteum due to extension of an inflammatory process.

(c) Bleeding during the endometrial stage of secretion is of unusual occurrence, and may be partly due to the premenstrual hyperemia of the pelvic organs.

4. Hemorrhage may occur in the middle of the menstrual cycle at a time corresponding to the rupture of the graafian follicle, the so-called "ovulation bleeding."

5. A type of hemorrhage characterizing hyperplasia of the endometrium is found when the menstrual periods become progressively more profuse or irregular and end finally in continuous bleeding.

6. Bleeding may occur following a period of amenorrhea in nonpregnant women of the childbearing age due to (a) hyperplasia of the endometrium, or (b) a traumatic or ulcerative lesion of the uterus following a previous removal or destruction of the ovaries.

7. Hemorrhage may occur at irregular times and without any connection with the events of the menstrual cycle, due to traumatic or ulcerative lesions of the cervix or endometrium resulting from newgrowths or inflammation.

8. Irregular hemorrhage due to the same causes as in Group 7 may occur in women past the climacteric. In rare cases ovarian newgrowths may also affect the endometrium and produce bleeding.

THE TREATMENT OF "IRREGULAR UTERINE HEMORRHAGE" BY THE FEMALE SEX HORMONE*

By Mark T. Goldstine, M.D., and Samuel J. Fogelson, M.D., Chicago, Ill.

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THE clinical application of the female sex hormone is still a difficult problem to the scientific gynecologist, despite the advances that have been made by the physiologists. This is particularly true because we are confused by the fact that there are undoubtedly two hormones in the ovary and that these two hormones have an antagonistic action. The problem is still further confused by the fact that what we call the female sex hormone is found not only in the ovary but also in the placenta, amniotic fluid, urine, and blood during pregnancy and in the blood of sexually active women just prior to menstruation. With menstruation it disappears from the circulation, being discharged with the menstrual flow. We are also reasonably certain that the effects of both of these hormones are under the control and markedly altered by the action of other glands of internal secretion, particularly the anterior lobe of the hypophysis. This naturally complicates any ovarian therapy, the question arising as to which gland is primary in the treatment. Add to this the possibility that all experimental data compiled by the physiologists may not apply to human beings as it does to experimental animals and the true scientific application of the female sex hormone in clinical work becomes a phase of gynecology from which any conclusions may be drawn only after the most critical and skeptical analysis.

The physiologists have, in the past few years, reached some striking conclusions which, when correlated, explain our clinical failures.

Brouha[3] found that the typical placentomatous reaction could be obtained in female white rats if the uterine mucosa were irritated surgically after the injection of anterior hypophyseal fluid. These pituitary injections acted directly on the ovaries, inhibiting follicle formation, and resulted in the formation of many corpora lutea. The corpora lutea in turn sensitized the uterine mucosa so that the placentomas followed the irritation. If the irritation preceded the anterior hypophyseal injections so that the corpora lutea were not present at the time of surgical irritation, no placentomas resulted. Nor were these the only prerequisites. The results were also negative if the anterior pituitary was injected for too long a period, during which the stimulating effects of the follicle on the uterine mucosa had disappeared. Placentomas developed only when the decidua was sensitized indirectly by the hypophysis through the corpus luteum while still under the influence

of the follicular hormone.   This indicates that probably during gestation there are two hormones in the ovary which are under hypophyseal influence, and that both of these are essential in the normal generative processes.

The presence of two hormones in the ovary was further substantiated by Hisaw,[11] who observed that in guinea pigs the pelvic ligaments relaxed and the symphysis separated during pregnancy.   This reaction could be reproduced by luteal extracts or by the blood of pregnant animals, provided the guinea pigs were still under the effects of the follicular hormone.   No relaxation could be obtained in castrated animals unless they were brought into estrus by the injection of follicular extracts. Moreover, the greatest relaxation and separation of the symphysis resulted when the animal was under the maximum effect of the follicular hormone, which is at the height of estrus.   All this would indicate a synergistic action of the two ovarian hormones, despite the fact that numerous physiologists and clinicians have demonstrated the ability of an active corpus luteum hormone to inhibit estrus in rodents, which supports the theory of antagonism between the two ovarian hormones.

The interrelationship of hormones was further demonstrated by Weichert,[16] who, using a corpus luteum extract, obtained the same results as did Brouha with his anterior hypophyseal fluid, namely, a placentomatous reaction.   To this may be added the experimental data of Corner and Allen[4] who demonstrated that alcoholic extracts of the corpus luteum, free of phospholipoids, would give the placentomatous reaction when injected into castrated adult female rabbits, whereas extracts of follicular fluid fail to give this reaction.   Light is thus cast upon our clinical failures with ovarian therapy.   Frank, Goldberger and their coworkers[6, 7] have concluded also that there are two hormones in the ovary, one of which is a water-soluble fraction of the corpus luteum which inhibits growth of the ovarian follicles and sensitizes the uterus for the placentomatous reaction expected in pregnancy, and the other is the estrus-producing hormone.   In fact, they conclude ''that the corpus luteum, like the anterior lobe of the pituitary, is able to elaborate two distinct and different hormones simultaneously, both of which are necessary for complete function of the genital tract.''

Friedman[10] injected the urine of pregnant women intraperitoneally into nonpregnant rabbits and found that the ovaries developed numerous corpora lutea which histologically showed retained ova with lutein transformation of the corpus hemorrhagica.   If the rabbits were, however, injected intravenously there resulted within twenty-four hours a typical corpus luteum with extrusion of the ovum, a condition found only in the rabbits postcoitum.   Aschheim and Zondek[18] have reported similar results and conclude that the urine of pregnant women is capable of producing the same biologic effect as the anterior lobe of the hypophysis.   Fels,[5] in an interesting experiment with parabiotic animals, demonstrated that the hypophysis dominated the condition of the genital tract in both animals anastomosed and that the female sex glands were entirely under its influence.

In addition to all this work by biologists, Wilfred Shaw,[15] in an excellent study of 200 cases of ''irregular uterine hemorrhage'' decided, from histologic study of the ovaries, that in 152 ''there is good reason to believe that the menstrual disorders met in the cases considered result from ovarian disorders and are not, as has been formerly believed, due to abnormalities of the endometrium and myometrium.''

We have reached similar conclusions on the basis of years of histologic study of specimens obtained surgically in cases of ''irregular uterine hemorrhage.''   We have become convinced that, as these patients approached the menopause, the direct etiologic factor of these ''irregular uterine hemorrhages,'' or the so-called idiopathic climac-

teric bleedings, was to be found in the ovary. Any other minor pathologic change was of little or no etiologic significance and could be dismissed as a primary cause, being, in fact, merely an associated condition. It seems logical to assume that at menopause there is a hypoovarian function which may be the responsible factor. The difficulty was to demonstrate this deficiency and then to supply the deficiency with the proper ovarian hormone.

Frank and Goldberger[7] demonstrated that the estrus-producing hormone could be readily isolated from the circulating blood of a normal female just before menstruation. This hormone when injected into a spayed female white mouse gave rise to a typical estral cycle. On the basis of this observation, we concluded that it should then be possible to demonstrate hypoovarian function by the absence of this reaction in the mice treated by the premenstrual circulating blood of our patients.

To complete the problem further, the proper ovarian hormone had to be selected to meet this deficiency. The selection necessarily had to be made from a follicular hormone which would be estrus-producing or from the corpus luteum hormone capable of giving the placentomatous reaction. This is a similar demonstration of specific activity to a positive Hisaw test, or in other words, the relaxation of the symphysis. Corpus luteum therapy proved unpractical, as we found no commercial preparation standardized for clinical use which would do this. There were, however, numerous well-standardized estral-producing preparations which we were compelled to use in the attempt to supply the ovarian deficiency. Indirect ovarian stimulation through the use of anterior pituitary hormone was also considered, but after experimentation with available commercial preparations, we concluded that they, too, were unreliable for clinical use.

During the past two years there have been available for study 33 cases of ''irregular uterine hemorrhages'' in which careful examination revealed minor pelvic diseases and in which the uterine scrapings eliminated all possibility of malignancy. Histologically, our observations were much the same as those reported by Fluhmann.[8] If we compare them with those in his group B of women over forty, we note a striking similarity with one exception. He found 1 case of simple endometrial hypertrophy in 33 cases while we find 6 in 31. This may be due to the fact that in 11 cases he had the complete uterus for study, while we had only curettements. There is no question that a more valuable conclusion can be drawn from a section which includes the musculature than from uterine scrapings. *However, our prime objective was a basis for explaining the bleeding and the varied endometrial picture suggested none.*

HISTOLOGIC OBSERVATIONS IN FLUHMANN'S, IN AUTHOR'S CASES

	Fluhmann (Group B)	Our Patients
Glandular hyperplasia of endometrium	23	16
Endometrial polyp	2	2
Simple hypertrophy of endometrium	1	6
Atrophy of endometrium	5	4
Normal endometrium	2	3
Total patients	33	31

Assuming that the uterine hemorrhage is secondary to a deficiency of the female sex hormone, all these patients with "irregular uterine hemorrhage" were next tested prior to menstruation by the Frank and Goldberger technic for the estrus-producing hormone in the circulating blood. This was difficult in our patients as there was no definite cycle to their menses, and despite the fact that the blood of 26 of the 31 patients in this series failed to produce estrus in spayed mice, we felt that no conclusion could be drawn from these negative results. The only other alternative for demonstrating hypoovarian function was to demonstrate the therapeutic effect of injection of an active, potent female sex hormone upon the bleeding of these patients.

The selection of an active hormone which would consistently produce estrus in our spayed mice was water-soluble, and was concentrated enough to be potent in small doses without giving significant local reactions, finally narrowed down to a preparation developed under the specification of Laqueur.[12] Fresh placenta is extracted first with benzene which is then evaporated off. The residue is triturated with alcohol which is also evaporated off and the residue is shaken with water, taking up the female sex hormone and leaving other lipoids.

Technic of Treatment.—If the patient was bleeding much, she was given an initial dose of about 100 mouse units. Whenever possible, fifty mouse units (assayed in our own laboratory on young mice) were injected intramuscularly every other day, beginning, if possible, early in the intermenstruum. The initial course varied from ten to fifteen injections, depending upon the response, and later treatment usually consisted of six injections, beginning about postmenstruum. This was continued until a normal menstrual cycle was established, menopause ensued, or the negative results convinced us of the inadequacy of the treatment.

Results.—Through the hypodermic injection of an aqueous estrus-producing hormone extracted from the placenta, it was possible to control "irregular uterine bleeding" in about 25 out of 31 women. Thirteen of these 25 successfully treated patients were eased into their climacteric and the other 12 have had their "irregular uterine bleeding" changed into what resembles normal menstruation for from two to six months. A hysterectomy in 2 of the 6 failures dis-

closed an undiagnosed submucous fibroid. The other 4 cases were not definitely disposed of.

COMMENT

These results are of special interest in view of the fact that Wintz[17] reports the control of 95 per cent of all uterine hemorrhages due to ovarian dysfunction through the injection of a lipoid substance obtained from the placenta, while we used an aqueous derivative. His preparation, moreover, checked the hemorrhage secondary to fibroids and abortion. Our results would indicate that the aqueous placental extract given to our patient acted only on the functional bleeding.

Novak[13] stated that "since estrus in the lower type is undoubtedly due to the follicle hormone, it seems clear that in the human being the maximum of follicle influence is reached during the interval phase, and that the later changes are due to the corpus luteum influence." We believe that our results tend to substantiate this opinion, for by the use of an aqueous estrus-producing substance free from lipoids we were able to restore our patients to the interval phase and check the so-called irregular uterine hemorrhage.

REPORT OF CASES

CASE 1.—Mrs. A. R., aged forty-four, a secundipara, whose youngest child was fifteen years old, began to have menorrhagia March 18, 1929, with prolongation of the menses until bleeding was continuous. Curettement was done April 2. Scrapings showed atrophic endometrium with some edema. There was no palpable pelvic pathology. The uterus was small and in good position. Serologic laboratory tests were negative. Injections of 50 mouse units were begun May 2 and continued every other day until fifteen injections had been given. The menstrual period May 15 was apparently normal. Six injections were given monthly, ten days previous to the expected date of menstruation. The periods became shorter and the flow diminished each month until November 14, 1929, when the patient had the last period of about one day's duration, followed by complete cessation of uterine hemorrhage. The patient was last seen February 15, 1930 and was in perfect health.

CASE 2.—Mrs. S. A., aged forty, a tertipara, had had her last pregnancy ten years before. Prolonged menstruation began February 18, 1928, and soon the patient menstruated a little almost every day. At times there was a two-day interval with no visible blood. Curettement was done December 27, 1928. There was no apparent pathologic change in the pelvis except for a slight enlargement of the uterus. Both tubes, the appendix, and one ovary had been removed five years previously. Sections showed a richly vascular hyperplastic glandular endometrium.

Injections of 50 mouse units were begun January 21, 1929, and continued every other day for thirty injections. The menstrual period occurred February 2. Six injections were given every month for seven months, ten days previous to the expected date of menstruation. Then three injections were given for four months. The menstrual periods are now regular, of from four to five days' duration with a moderate flow. No injections have been given since December, 1929, but blood has been examined each month for ovarian hormone up to February, 1930.

CASE 3.—Mrs. C. M., aged thirty-eight, a sextipara, had had her last pregnancy four years before. Prolonged menstrual periods began about March 9, 1928, with

the interval between periods shortening until at the time of observation there was about a nine to ten day interval. Examination on May 2, 1929, showed some minor pathologic change in the pelvis. The uterus was of about normal size and retroflexed; the appendages were apparently normal. Dilatation and curettage showed an apparently normal endometrium, slightly vascular with some edema.

On May 15, injections of 50 mouse units were begun and continued for fifteen injections. The first menstrual period occurred June 22 with a moderate flow for four days. Six injections were given monthly ten days prior to the expected period for five months, followed by three injections for two months. Since the last injection the flow has been less than normal in amount but the periods have been of some duration.

CASE 4.—Mrs. O. W., aged thirty-six, a nullipara, had been married eighteen years. There had been irregular prolonged menstruation since January 1, 1929, with an interval between periods of about fifteen days. On examination the patient appeared healthy. The pelvic examination was negative. The uterus was small and in good position; the appendages were apparently normal. The Rubin test showed patent tubes. Dilatation and curettage was done April 16. Scrapings showed endometrium with small glands, very little vascularity, some edema and a rather moderate atrophic endometrium. After leaving the hospital, the patient did not return until June 18, 1929, when she reported that following the curettage she had suffered continuous bleeding.

Injections of 50 mouse units were begun June 18, and continued every other day for twenty-two injections. The abnormal flow stopped July 8 and an apparently normal period occurred August 2. Six injections were given starting August 20, but no menstrual period occurred until September 28. Three injections were given starting October 20, but a period did not occur until November 29. It lasted one day and the flow was slight. The next and last period occurred February 3, 1930.

CASE 5.—Mrs. D. K., aged forty-one, a secundipara, had had her last pregnancy, a four months' miscarriage, at the age of thirty-two. Irregular and prolonged menstruation had been present since March, 1926, with a maximum interval between periods of ten days. Pelvic examination was negative except for mild cervicitis and moderate cervical laceration. Curettage was done April 18, 1929. Sections showed chronic endocervicitis and a somewhat polypoid hypertrophic glandular endometrium.

Injections of 50 mouse units were begun April 27 and continued for sixteen injections. An approximately half normal menstrual period occurred May 28. Six injections were given in June, with a short menstrual period July 7. Three injections were given for the next four months and at present the patient is having regular periods at about thirty-day intervals and lasting from three to four days.

CASE 6.—Miss I. R., had had irregular prolonged menstruation for one and one-half years and at the time of observation blood was present daily. Pelvic examination on August 26, 1929, revealed atrophy of all the pelvic organs, a small uterus in normal position and appendages free from pathologic conditions. Dilatation and curettage showed only a few small fragments of endometrium and sections showed an atrophic, edematous endometrium.

Injections of 50 mouse units were begun September 10, and continued for twelve injections. The patient had a menstrual period of one day with a small flow on October 29. Six injections were given in November. The patient is a graduate nurse employed at Northwestern University in Evanston, and has been using from four to six injections a month at irregular intervals. She has not menstruated since the last period in October, 1929.

CASE 7.—Mrs. E. S., aged forty-two, had been married sixteen years without becoming pregnant. Irregular prolonged menstruation had begun one and one-half years previous to observation. There was no definite interval between periods but it was never longer than five days. Pelvic examination was negative. Dilatation and curettage was done July 2, 1929, revealing a hyperplastic, hemorrhagic, premenstrual endometrium.

Injections of 50 mouse units were begun July 16 and were given every other day for thirty-one injections, during which time there was a slight pinkish discharge every day, and on October 1, an apparently regular menstrual period lasting eight days. At an interval of two weeks from the last period, menstruation occurred again. Injections were given every other day for fifteen injections, followed by rather profuse bleeding, starting November 26 and lasting six days. Injections were begun again December 12 and continued until the next period, December 27. Six injections were given in January with rather profuse bleeding of six days' duration. The periods have since been regular up to the present time.

CASE 8.—Mrs. E. F., aged forty-one, a quadripara, had had her last child eight years previously. Four years before she had had an operation for uterine prolapse, cystocele, and rectocele. An interposition operation had been performed. Pelvic examination, August 10, was negative. For the past three months the menstrual periods had been regular but less in amount than usual and greatly prolonged, with spotting of blood daily for the last month. Dilatation and curettage showed a moderately atrophic edematous endometrium.

Injections of 50 mouse units were begun August 20, and were given every other day for fourteen injections. No bleeding followed the dilatation and curettage and the patient menstruated, October 4, for two days, the flow being slight. Since then she has had regular periods with a much less than normal flow up to the present time.

CASE 9.—Mrs. A. F., aged forty-two, a tertipara, whose last child was thirteen years old, began having prolongation of her menstrual periods six months before examination, with shortening of the interval to about fifteen days. Her January period lasted ten days, from January 6 to January 16. A curettage in October, 1928, showed a hyperplastic endometrium and no evidence of malignancy.

The treatment consisted of hypodermic injection of 50 mouse units of female sex hormone on January 18, 20, 22, 24, and 27, and February 1, 3, 5, and 9. Menstruation began again February 10, after an interval of about three and one-half weeks and was of four days' duration. The treatment was again started February 19 and continued February 21, 23, and 26 and March 2 and 5. Menses occurred again from March 11 to 13. Treatment was given on April 5, 7, and 9, and a very scanty menstrual period occurred from April 11 to 13. The last course of injections was given May 6, 8, 10, 13, and 15. The patient has had no further menstruation, having last been seen in September, 1929.

CASE 10.—Mrs. R. B., aged forty-one, a quadripara whose youngest child was seventeen years old, had been perfectly well until about four months before when her periods gradually became longer and more profuse until they were now of ten days' duration, although the interval had remained about three weeks. The basal metabolic rate was plus 20; the blood pressure was 140/80, the red blood count 3,100,000. Uterine scrapings in November showed a hyperplastic endometrium with marked edema of the stroma. The last menstrual period was from December 19 to January 1, 1929.

The patient was treated by hypodermic injections of an aqueous solution of 50 mouse units, January 7, 9, 11, 14, and 18. The next period was of normal amount and lasted only four days, from January 20 to 24. The same treatment was repeated February 4, 6, 9, 11, and 15, with another normal period occurring

from February 16 to 19. March 4, 7, 9, 11, and 15 she received 50 mouse units again and menstruated March 18 to 20 very scantily. This patient insisted on further treatment, so she was given more injections April 1, 3, 6, 8, and 11, with a scanty period again April 11 to 13. *Then she received no treatment in order to determine the effect of withdrawal of the hormone and she had a profuse period from May 1 to 10.* Treatment was again instituted and she was given 50 mouse units May 25, 27, 29, and 31, and June 1, with the result that she had a scanty period from June 2 to 5 and it seemed advisable to supply her with more hormone on June 19, 22, 24, and 27 and July 1. She had no period in July, so she was not given any treatment. When the patient was last seen, August 22, she was in apparent perfect health and had had no further menstruation.

CASE 11.—Mrs. R. B., a nullipara, aged thirty-nine, had her periods prolonged within the last six months from four or five days to nine or eleven days with only a slight decrease in the interval. She was physically normal and her history was uneventful. A diagnostic curettage three months before had revealed a classic hyperplastic endometrium. The last period was from December 10 to 21 and was very profuse, with the result that when it terminated her red blood count was down to 3,000,000. She received hypodermically 50 mouse units on January 5, 7, 10, 11, and 14 and menstruated four days, from January 15 to 18. She was given further injections February 1, 4, 6, and 9 and menstruated February 11 to 14, the red blood count now being 3,400,000. She was treated on March 1, 4, 5, and 7, and menstruated March 8 to 11, so treatment was again started and she was given injections March 25, 27, and 30 and April 1, with menstruation starting April 3 and stopping April 5. The final course of treatment was given April 22, 24, 26, and 29 and May 1, because the patient ceased to menstruate. When she was seen August 16, she was apparently in perfect health.

CASE 12.—Mrs. A. M., aged thirty-eight, a nullipara, married nineteen years and never pregnant, had had no menstrual complaints until October, 1928, when her periods changed from the five to six day time to ten to twelve days, although the interval remained about four weeks. The physical examination and history were essentially negative. Uterine scrapings taken in November showed a hyperplasia of the endometrium. Her last period prior to this observation had been from December 24 to January 4.

The patient received the usual treatment of 50 mouse units on the following days: January 18, 21, 23, 26, and 28, menstruating three days, from January 30 to February 2, more profusely than normal but much less than in the past five months. The treatment was again given February 18, 20, 22, and 26, with a scanty three-day menstrual period from February 28 to March 2. Another course of injections was given March 31 to April 2. Treatment was continued April 22, 25, and 27, and menstruation followed on April 29 to 30 with a very scanty flow. She received no further treatment and menstruated scantily May 26 to 27, and again June 21 to 22. The patient was last seen August 10 in excellent condition, at which time she reported that she still was menstruating about two days of each month.

CASE 13.—Mrs. J. J., aged thirty-eight, a secundipara whose youngest child was fourteen years old, developed menorrhagia in February with prolongation of periods to from twelve to fifteen days without intermenstrual bleeding. Curettage was done April 2 and scrapings were reported as simple hypertrophy of the endometrium. The last period had been from March 14 to March 25.

Hypodermic injection of 50 mouse units of female sex hormone was started April 8 while the patient was still bleeding posteurettement, and was continued every other day until May 2 when it stopped. Menstruation occurred again May 7 to 9 and was very scanty. Injections were again given May 10, 11, 16, 18, and 20.

Menstruation occurred from June 4 to 7. Treatment was resumed June 18, 21, 24, and 26, and the menses occurred July 1 to 2, being very scanty. No further treatment was given with the expectation that menorrhagia would recur, but the menses again occurred July 29 to 31 and were of normal amount. The patient received no further treatment and was last seen November 22, at which time she reported no further menstrual abnormalities.

CASE 14.—Mrs. M. F., aged forty, a tertipara, had had her last pregnancy eleven years before and had had both menorrhagia and metrorrhagia for the past seven months when first seen April 11. A curettage had been done for diagnosis and as a therapeutic measure January 10, 1929, but the abnormal menses continued. Examination showed an apparently normal premenstrual endometrium and treatment was started while the patient was bleeding profusely, April 11, with 150 mouse units of female sex hormone, as there was no apparent pelvic disease. On April 13, the patient was still bleeding a little, so 150 mouse units were again injected. Uterine bleeding stopped April 14, and 50 mouse units were injected every other day for twenty days. The menses recurred May 4 to 7 and were of rather profuse amount. Treatment was again started May 13, and continued every other day until bleeding reappeared, June 1, 50 mouse units being injected at each time. The June period was very scanty and lasted only three days, stopping on June 4. Treatment with 50 mouse units of the female sex hormone was given again June 15, 17, 19, and 23. The menses occurred again from June 29 to July 1, and again were scanty. Treatment was resumed July 15, 17, 20, and 23 with the menses occurring July 27 to 29. No further treatment was then given. The patient was seen October 2 and reported normal menstruation in August and September. She has failed to return for further observation.

CASE 15.—Mrs. A. L., a tertipara, aged thirty-eight, had had her last pregnancy eleven years before the menorrhagia of at least two weeks' duration for the past five months, the last period continuing from April 22 to May 2. Curettage, April 15, showed edema and hyperplasia of the endometrium. The remainder of this patient's history and physical examination were negative. Treatment consisted of 100 mouse units on May 2, and 50 mouse units on May 6, 8, 11, 13, 15, 18, 21, and 23, respectively. Menstruation occurred from May 20 to June 2 and was of normal amount. Treatment was started again on June 15, and continued June 17, 20, 22, and 24; the next period was scanty in amount from June 28 to July 1. Another course of treatment was given July 13, 15, 18, and 20, with the next period from July 27 to 30. The patient received no further treatment and was last seen in January 1930, when she reported that she still was menstruating once a month for from three to five days.

CASE 16.—Mrs. H. S. (Dr. P. S.), aged thirty-nine, a nullipara, married for ten years during which time she had never been pregnant, had had some unknown pelvic operation seven years before, following which the menses at first were irregular and then, during the past three years, had become gradually prolonged with a shorter interval, until now she was bleeding more than half the time. Periods were at least fifteen days long, with an interval of about the same time. There was no bleeding between the menses, and scrapings taken twice during the past two years had been reported as glandular hyperplasia with some edema of the stroma. The remainder of the history was negative and the pelvis was normal except for the uterus, which was about one and one-half times the normal size. The last period began May 11 and the patient was still bleeding profusely when seen on May 22. Injections of 50 mouse units were started May 22 and continued every other day until ten had been given. She stopped bleeding May 25 and the next period started June 20 after an interval of three weeks and five days, which was the longest interval in three years. Six injections were given monthly, ten days

previous to the expected day of menstruation, and the periods gradually became shorter, until the last period of two days occurred in December. The patient was last seen in March, 1930, and had not menstruated since December. She was apparently in perfect health.

CASE 17.—Mrs. G. R., aged forty-two, a tertipara, had had her last pregnancy fifteen years before and a thyroidectomy three years before, following which menstrual irregularities started, until she noticed there was bleeding twice a month, usually five days during the first week and then after a two-week interval again for about ten to fourteen days. The patient had a mild case of diabetes easily controlled by diet, a normal basal metabolic rate, and a normal pelvis. She was first seen May 30, after she had just finished a period of thirteen days. Uterine scrapings taken in January, 1929, had shown a glandular hyperplasia with "piling up of the glands." Injections of 50 mouse units were begun immediately and continued every other day for fifteen injections. She failed to menstruate in June and her July period lasted from July 2 to 5. Six injections were given every other day about ten days previous to the next expected date of menstruation, and the patient had normal periods in August, September, October, and November. She has failed to menstruate since and was last seen in February, 1930, in excellent health.

CASE 18.—Miss A. L., aged thirty-five, had been treated for splenomegaly in January, 1929, with x-rays and when first seen, June 11, had marked hot flashes, headaches, emotional instability and marked menorrhagia, her periods lasting about fifteen days out of every month. The laboratory reports on the blood were negative and the spleen could not be palpated when she was seen in our clinic. The pelvis was normal and the scrapings showed a normal premenstrual endometrium. Injections of 50 mouse units were started immediately and continued every other day until twelve were given. She bled for four days, from July 4 to 8, and reported that all the subjective symptoms were gone. Six injections were given every month for three months, beginning about fourteen days prior to the expected date of menstruation. Her August period also lasted for four days. In September, she menstruated three days, and missed her period in October. In November, she spotted for three days and then stopped completely. When seen again in February, she reported no further menstruation and apparently had recovered from her menopausal symptoms.

CASE 19.—Mrs. M. G., aged thirty-five, a nullipara, first seen June 25, 1929, reported nervousness, tremor, emotional instability, and loss of weight together with menorrhagia ever since she had been poisoned by gas escaping from her refrigerator early in January, 1929. Her basal metabolic rate was within normal limits and she was essentially normal physically, except for a mild tachycardia. Uterine scrapings obtained in April showed a simple hypertrophy of the endometrium. Her last menstrual period lasted from June 13 to June 24 and was very profuse. She received the usual ten injections of 50 mouse units given every other day beginning June 25. Her next period was of four days' duration, from July 20 to 24. Then she was given six more injections, beginning August 5. Her next period from August 17 to 20 was very scanty. She refused further treatment and was seen again in December, reporting normal menstruation in the intervening months and marked alleviation of her nervous symptoms.

CASE 20.—Miss B. G., aged thirty-nine, gave a history of very scanty menstrual periods until four years before, when she had been treated for six months with some unknown injections and with thyroid by mouth. After this treatment she first had what seemed to her to be normal menstruation, but about eighteen months before, became convinced her periods were much longer than normal with shortening of the interval. The past six months she has menstruated two weeks out of

every month. Uterine scrapings taken in June, 1929, showed a normal premenstrual endometrium, and following this curettement she bled for sixteen days, ending about June 31. She was given fifteen injections of 50 mouse units every other day beginning July 3 and missed July entirely, menstruating next in August from August 8 to 12. During the next two months she received six injections every other day and menstruated normally in September and October, no more menstruation being reported when she was last seen in February, 1930.

CASE 21.—Miss K. F., aged thirty-nine, with an uneventful history, began having irregular menstruation about fifteen months before and for the past four months had had periods that lasted about fourteen days together with occasional spotting in the interval. The pelvis was normal and uterine scrapings taken in April, 1929, showed simple hypertrophy of the endometrium. The patient was first seen July 24, having had her last period from July 9 to 22. Injections of 50 mouse units were begun immediately and continued every other day until fifteen had been given. Her next period was from August 20 to 31. Six injections were given every month for seven months about ten days previous to the expected date of menstruation, and she has had normal periods of about three to five days' duration. The March period was also normal, despite the fact that she received no treatment.

CASE 22.—Mrs. B. K., aged forty, was first seen August 11, when she reported a gradual prolongation of menstruation with some shortening of the interval for the past five months. Uterine scrapings in June showed a glandular hyperplasia and the usual treatment failed to control the hemorrhage. Her last period started August 1 and she was still bleeding profusely August 11, when the treatment was started. She received 50 mouse units every other day until ten injections had been given and spotted for one day in the middle of September, after which she received six more. She failed to menstruate in October and received no treatment. When last seen in February, 1930, the patient reported no further menstruation and appeared in excellent condition.

CASE 23.—Mrs. K. S., a quadripara, aged forty-five, with a negative history, appeared essentially normal on physical examination, except for the left ovary which was about twice the normal size and felt as thought it were cystic. The patient was first seen August 21, 1929, when she complained of menstruation of two weeks' duration with a two weeks' interval. Her next period was from September 1 to 9 and was very profuse, her red blood count dropping to 3,000,000. She was given 50 units of the female sex hormone September 16, 18, 20, 22, 24, 26, and 30, respectively. The next menstruation occurred September 27 to October 1, after an interval of twenty-six days. The treatment was again started October 14, 16, 18, 20, 22, and 24, and she again menstruated from October 26 to 29, very scantily, after an interval of twenty-six days. The cessation of treatment was attempted and on November 23 a very profuse period of seven days' duration commenced. On December 18, 20, 22, and 24 she was given 50 mouse units of female sex hormone and the flow lasted three days, from December 25 to 28.

The patient received no further treatment and had one more period of two days' duration February 22 to 23, but missed her March period. Apparently, it was possible by this therapy to ease the patient into a normal menopause without surgical, x-ray, or radium intervention.

CASE 24.—Dr. S., a nullipara, aged thirty-one, with a normal pelvis, had had a thyroidectomy two years before and since then had had an irregular menstrual history, usually bleeding twice a month for varying periods from eight to ten days. The amount of blood lost was marked and during this time she had had two menstrual hemorrhages lasting the entire month. January 22, after bleeding profusely for seven days, she was given 100 mouse units hypodermically and then 50 units on January 25, 26, 27, and 29 and February 3, 5, and 7. The next

period was very scanty, occurring from February 8 to 11. Treatment was again started February 22, 25, and 28 and March 1, 2, 4, 6, and 8. The next menses were from March 22 to 26, also being very scanty. Curettage in November, 1929, showed hypertrophic endometrium.

CASE 25.—Mrs. L. S., a nullipara, aged thirty-nine, with history and physical examination essentially negative and with no pelvic disease, had a marked anemia with 3,000,000 red blood cells and a hemoglobin of 65 per cent when she bled continuously for twenty-six days. Menstruation was irregular until April, 1929, when she bled continuously for eighty days. This atypical menstrual history continued with periods of from one to thirty-three days and intervals never over fourteen days. Curettage was done July 3, 1929 and no evidence of a malignant condition was found, but a definite hyperplasia of the endometrium was evident. The last period was from December 4 to 11 and was very profuse.

The treatment began December 14 with 100 units of the female sex hormone and 50 units were given December 15, 21, 23, 27, and 30, and January 3, 7, 10, 13, 16, 20, 22, and 25. The next uterine bleeding occurred February 5 to 9, with an interval of six weeks, in a patient in whom, for two years, some bleeding had occurred always before a two weeks' interval had elapsed. Treatment was started again February 15, 17, 20, 22, 25, and 28, and the next menstruation occurred March 3 to 5 and was very scanty. The interval was about four weeks. The effect of no treatment was next observed, and ten days later the patient began to bleed and bled profusely until March 25, when she was given 150 mouse units, which stopped the bleeding on March 26. Another series of five injections of 50 units every other day was started and on March 30 the patient was not bleeding.

REFERENCES

(1) *Allen, Willard M.:* Am. J. Physiol. 92: 174, 1930. (2) *Allen, E., Pratt, J. P., Newell, Q. V., and Bland, L. J.:* Am. J. Physiol. 92: 127, 1930. (3) *Brouha, L.:* Proc. Soc. Exper. Biol. & Med. 25: 488, 1928. (4) *Corner, George W., and Allen, Willard:* Am. J. Physiol. 88: 338, 1928. (5) *Fels, E.:* Arch. f. Gynäk. 138: 16, 1929. (6) *Frank, R. T., and Goldberger, M. A.:* J. A. M. A. 90: 106, 1928. (7) *Frank, R. T., and Goldberger, M. A.:* J. A. M. A. 87: 1719, 1926. (8) *Fluhmann, C. F.:* J. A. M. A. 93: 1136, 1929. (9) *Frank, R. T., Gustavson, R. G., et al.:* Am. J. Physiol. 90: 727, 1929. (10) *Friedman, Maurice:* Am. J. Physiol. 90: 617, 1929. (11) *Hisaw, Frederick L.:* Physiol. Zool. 2: 59, 1929. (12) *Laqueur, E., Hart, P. G., and deJongh, S. L.:* Lancet 1: 1126, 1927. (13) *Novak, Emil, and Everett, H. S.:* AM. J. OBST. & GYNEC. 16: 499, 1929. (14) *Novak, Emil:* J. A. M. A. 94: 833, 1930. (15) *Shaw, W.:* J. Obst. & Gynec. Brit. Empire 36: 1, 1929. (16) *Weichert, Charles K.:* Proc. Soc. Exper. Biol. & Med. 25: 490, 1928. (17) *Wintz, Herman:* Deutsche med. Wchnschr. 1: 67, 1924. (18) *Zondek, B.:* Klin. Wchnschr. 8: 157, 1929.

25 EAST WASHINGTON STREET.

A STUDY OF THE HEMOGLOBIN, CELL VOLUME PER CENT AND RED CELL COUNT, INTRAPARTUM AND POST-PARTUM, WITH OBSERVATIONS ON RELATION TO MORBIDITY

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THE occurrence of a severe type of anemia in pregnancy has engaged the attention of clinicians since the time of the earliest reports on anemia.[1] This subject was carefully reviewed by Pepper[2] in 1929, and more recently by Reuben Peterson[3] and his associates who reported additional cases treated by liver and liver extracts. Many reports have appeared emphasizing the frequent occurrence of low hemoglobin values and red cell counts incident to pregnancy.

The object of this investigation was to learn what the usual blood findings are at the termination of pregnancy, the variation subsequent to delivery and possible related factors, and finally whether deviations from the usual have a bearing on the satisfactory termination of pregnancy.

The study itself is concerned with the hemoglobin, cell volume per cent, and red cell count on one hundred women during labor and on the fifth to seventh day postpartum. The women for the study were selected at random, including both house and private patients, and representing all classes of society. Clinical and serologic evidences of syphilis were absent in all cases. No patients were included in whom the later months of pregnancy had been complicated by hemorrhage or febrile conditions. The studies were carried on during November and December, 1929, and March, 1930. In addition to the record of the blood studies, notations were made on the method of delivery, the number of hours in labor, the estimated or measured blood loss in delivery, and significant observations on the condition of the patient and character of the puerperium, if abnormal.

The hemoglobin readings were made by the author, using one of the newer types of Sahli apparatus.[†] In order to standardize the illumination, the color comparisons were made before a "daylight" lamp with a frosted glass window. The readings will be presented as hemoglobin per cent (Sahli), but in the discussion to follow the *approximate* value, in grams of oxyhemoglobin per 100 c.c. of blood will at times

appear also in parenthesis. This translation is given in order to compare the results with the work of others in which different standards have been used.

The red cell counts were, for the most part, made by a technician who assisted in this part of the work, and in a lesser number of cases by a member of the resident staff. In making the red cell counts a standardized Neubauer counting chamber and Thoma pipettes were used. Both hemoglobin determinations and red cell counts were made from blood secured by finger puncture. For absolute accuracy this method is open to criticism, but for purposes of comparison in a clinical study it seemed to be the one of choice. In order to check this point, counts were in some instances made on both the blood from finger puncture and from the vein. In one patient in whom the edema was very marked, the count was 800,000 higher on blood taken directly from the vein. In others the variation was much less marked or negligible. The hemoglobin values were observed to vary in proportion. This point seems worthy of more extensive investigation.

In determining the cell volume per cent, Sahli hemoglobin tubes were used. These were checked for accuracy of bore and calibration. The tubes were filled to the 10 mark with 1.6 per cent sodium oxalate solution. Blood was drawn from the vein in a dry sterile syringe and the tube was filled to the 110 mark. The blood and oxalate solution were gently mixed by rocking the tube. The tubes were then centrifuged and the cell volume read directly in per cent. After a number of trials it was observed that, if sedimentation of the oxalated blood were allowed to take place for thirty minutes and then centrifuged for thirty minutes, further packing of the cells did not occur by prolonging this final period. The addition of the oxalate solution as an anticoagulant, according to Osgood,[4] gives slightly higher reading (3.5 per cent) than when powdered oxalate or citrate is used. This part of the study was carried out entirely by the author. While the determination of the cell volume per cent cannot be considered strictly suitable for routine clinical examinations, it serves as a check against the hemoglobin readings and cell counts. It also serves, with the hemoglobin reading, as an indicator of the qualitative value of the red cells.

REVIEW OF THE LITERATURE

Studies on the blood and pregnancy differ widely in their conclusions. Confusing and contradictory reports can in part be explained by the lack of uniformly accepted standards and by varying methods. Osgood and Haskins[5] in a study of the blood in 100 normal women between the ages of eighteen and thirty concluded that 13.7 grams of oxyhemoglobin per 100 c.c. of blood represented an average. This value approximates 100 per cent by the Dare method and 64.5 per cent by the Sahli. They also found an average cell volume per cent of 41, and an average red cell count of 4.6 million. These figures correspond closely to observa-

tions made by Gram and Norgaard.[6] Haden[7] secured approximately the same averages for hemoglobin and cell count, but by a method similar to the one used in this study, found the average cell volume per cent to be 46.2. These studies were all made on blood drawn from the vein.

Kuehnel,[8] in studying blood taken from the vein in 15 women during pregnancy, used a method similar to that of Osgood and Haskius. He considered 92 per cent hemoglobin (Sahli), 41.5 cell volume per cent, and 4.75 million red cells as normal. His curves show a gradual decline in hemoglobin, cell volume per cent, and erythrocytes during the first sixteen weeks, followed by a period in which the values are stationary, and then a slight rise during the last eight to ten weeks. In the first twelve hours postpartum, the hemoglobin, cell volume per cent, and red cell count fell sharply, but by the sixth or seventh day postpartum they rose above the antepartum level. Both DeLee[9] and Williams[10] state that such a curve represents the usual variation in the hemoglobin and red cell count throughout pregnancy.

Bland and his coworkers,[11] using 13.8 grams of oxyhemoglobin (Dare) as standard (method of securing the blood not stated), reported that 81.5 per cent of pregnant women gave hemoglobin estimates of 74 per cent (10.3 grams) or less, and red cell counts of less than 3.5 million, and 17 per cent were less than 4.0 million. Of 156 patients studied in the last trimester of pregnancy, 55.7 per cent showed less than 3.5 million cells. They further observed that of those with red cell counts less than 3.5 million before labor, 71 per cent gained 200,000 red cells or more in the first seven to ten days postpartum, while only 19 per cent showed a loss of 200,000 red cells or more. Of those having counts of 4 million or over, only 33 per cent showed a gain, while 50 per cent showed a loss. The difference in hemoglobin and red cell counts as found in clinic and private patients was negligible. They also concluded that parity bore no relation to low hemoglobin readings.

In 100 patients studied during pregnancy, Moore[12] found an average hemoglobin reading of 77.7 by Dare (10.6 grams) and an average red cell count of 4,140,675. The average hemoglobin reading was slightly higher in multiparae, while the cell count was slightly lower. Kerwin and Collins,[13] presumably by the same method, found in a study of 86 clinic patients, an average hemoglobin reading of 82 per cent, 15.1 per cent giving readings of 70 per cent or less. The averages were only slightly lower in multiparae than in primiparae.

Galloway[14] found the average for 382 (Sahli) hemoglobin determinations in the third trimester to be 66 per cent (14 grams), and the average for 352 red cell counts in the third trimester to be 3.88 million. On the third day postpartum the average of 179 hemoglobin determinations was 75.53 (16 grams) and red cell counts 4.1 million. On the eleventh day postpartum, the averages for 158 patients were, hemoglobin 82.06 per cent (17.4 grams) and red cell count 4.4 million. These studies were made on private patients.

Lyons[15] in a study of 177 clinic patients approximately at term, found the average Sahli hemoglobin reading to be 75.3 per cent (16 grams). In 22.6 per cent of this number the hemoglobin reading was from 71 to 75 with an average red count of 3,842,000 and in 32.2 per cent the hemoglobin was 70 or less with the red count averaging 3,514,000. He compared these findings with those in a group of women admitted to the surgical service for uncomplicated retroversion and found the occurrence of low hemoglobin values in nearly the same ratio. He concluded that the high incidence of anemia in pregnancy is not dependent on the pregnancy, but to a considerable extent represents a preexisting anemia associated with pregnancy. In the studies of both Lyons and Galloway it is to be observed that while the red cell counts are low the hemoglobin values compare favorably with those found by Osgood and Haskins in normal women.

ANALYSIS OF FINDINGS

For purposes of study, the patients were classified as primiparae and multiparae and further subdivided into private and house patients. A study of Table I shows but slight difference between multiparae and primiparae, and between private and house patients. The hemoglobin does not vary between the groups and from the general average by more than 2 per cent. During the month of February the average hemoglobin reading was 64 per cent for 50 consecutive admissions not included in this study. In a comparison of the general average of intra- and postpartum hemoglobin determinations, a slight tendency to gain is observed. This is true also in all the groups excepting the private primiparae. A further study of the table shows approximately the same relationship between the intrapartum and postpartum cell volume per cent readings and red cell counts. The group of house primiparae was made up of the younger women admitted through the Social Service department late in pregnancy. Among them the incidence of foetal infection was especially high, many of them suffering from pyelitis, abscessed teeth, and chronic throat and sinus infections. This may easily account for the lower findings as compared to private primiparae. Assuming that, with the instrument used, 100 per cent represents 21.3 grams oxyhemoglobin per 100 c.c. of blood, the average of 64.5 per cent (13.8 grams) is the same as that found by Osgood and Haskins for normal women. It is nearly the same as the average hemoglobin reading of 64 per cent for 50 consecutive admissions. In comparison to their normal of 4.6 million red cells, the average for this study 3.58 million cells is only 77.8 per cent of the normal number. Using Haden's cell volume per cent average of 46.2, secured by a similar method, the average cell volume per cent of 39.8 represents 86 per cent of the normal. Using the Osgood and Haskins value of 41 increased by 3.5 per cent, the result becomes 39.5/425 or approximately 93 per cent of their average normal. The average for hemoglobin and cell counts bear approximately the same relationship to each other as found by both Galloway and Lyons. The averages themselves are, however, lower and the postpartum increase in hemoglobin and cell count is less marked. The average cell counts are nearly the same as found by Bland and his associates, while the hemoglobin average of 64.5 per cent (13.7 grams) is higher than his average Dare reading.

The occurrence of cell volume per cent averages which are relatively higher than the cell count, might be explained by two, or possibly three, factors. First: The cell volume per cent readings were made on venous blood and not subject to serum dilution, as in the specimens secured for cell count by finger puncture. Considering the postpartum increase in six patients in whom edema was remarkable, the average increase in hemoglobin was 12 per cent, and in cell count 437,000,

TABLE I. AVERAGE HEMOGLOBIN PER CENT, CELL VOLUME PER CENT AND RED CELL COUNT (in millions)

FOR DIFFERENT CLASSES OF PATIENTS

	NUMBER OF PATIENTS	SAHLI HB. IN LABOR	HB. 5 TO 7 DAYS POST-PARTUM	CELL VOLUME PER CENT IN LABOR	5 TO 7 DAYS POST-PARTUM	RED CELL COUNTS IN LABOR	5 TO 7 DAYS POST-PARTUM	HOURS IN LABOR	NUMBER OF OPERATIVE DELIVERIES
Primipara, House	23	63.8	64.5	37.0	37.0	3.56	3.58	17-	14
Multipara, House	25	64.5	67.0	38.5	40.0	3.35	3.45	10-	2
Primipara, Private	32	64.4	63.5	39.6	39.0	3.64	3.70	14	7
Multipara, Private	20	65.0	66.1	39.3	40.7	3.78	3.90	12	3
Average	100	64.5	65.2	38.7	39.3	3.58	3.66	13	26
Primipara	55	64.4	64.4	38.8	38.4	3.61	3.66	15	
Multipara	45	64.5	66.5	38.8	40.2	3.54	3.66	11	
House	48	64.2	66.0	38.2	38.8	3.45	3.52	13	
Private	52	64.8	64.5	39.5	39.5	3.62	3.71	13	

while the cell volume per cent increase was only 2.6. (See Table II.) By the fifth to seventh day this edema had, to a great extent, disappeared and specimens suffered less dilution. This is probably not important except in patients with marked edema, but it affects the general average. Second: The increase in the number of white blood cells at the end of pregnancy and in the puerperium would raise the total cell volume per cent slightly above that of nonpregnant women with the same red cell count. The third factor is entirely speculative. In view of the finding of relatively higher hemoglobin averages than cell counts, not only in this series, but also by Galloway and by Lyons, it seems logical to assume that the oxygen carrying capacity of the cell may be increased to compensate for the quantitative decrease in red cells, and with this increase in the amount of hemoglobin in the cell, a slight increase in the size of the individual red cell. This would mean that both the color index and volume index were greater than one. This point apparently hinges on what value is to be taken as a normal hemoglobin. Little support for such a suggestion is to be found in the literature.

TABLE II. COMPARISON OF GAIN IN HEMOGLOBIN, CELL VOLUME PER CENT AND RED CELL COUNT IN THE SIX PATIENTS SHOWING MARKED EDEMA

HB. PER CENT GAIN	CELL VOLUME PER CENT GAIN	GAIN IN R.B.C. IN THOUSANDS
12	1	280
8	1	300
4	2	572
15	7	808
15	1	307
20	4	356
Aver. Gain 12%	2.6	437

In a study of Table III it is observed that 53 per cent of women in labor gave hemoglobin readings under 65 per cent, while postpartum 47 per cent gave readings under 65 per cent. Table IV shows that 47 per cent gave cell volume per cent readings under 39 before delivery, while postpartum only 39 per cent fell below 39. Table V shows that 46 per cent of the total series gave red cell counts under 3.5 million and only 15 per cent had 4.0 million or above. This incidence of low cell counts coincides with the observations of others, and may be considered as a rather constant finding at or near the end of pregnancy. It is questioned whether women in general show counts of such a low level as suggested by Lyons. A survey of the blood counts on 100 consecutive patients admitted to the surgical and gynecologic services during January, February and March for conditions in which neither fever nor blood loss occurred, showed that the average red count was 4.3 million. Only six counts fell below 4.0 million.

These counts were made by the same technician who made the counts on obstetric patients.

A reference to Table I shows, as noted, a slight tendency toward postpartum gain. In a tabulation of loss and gain (Tables III and VI), 28 per cent gained 5 per cent or more hemoglobin, and 33 per cent gained 200,000 or more cells. This is influenced by two factors. The first has been discussed in reference to edema at the end of pregnancy and its loss by the fifth to seventh day. The second is the concentration of the blood and reduction in the total volume of circulating blood as shown by Keith, Rowntree and Geraghty.[16] They reported

TABLE III. RANGE AND VARIATION IN HEMOGLOBIN READINGS

NUMBER OF PATIENTS		INTRAPARTUM			5 TO 7 DAYS POST-PARTUM			NO SHOWING 5% OR MORE	
		UNDER 65%	65% TO 69%	70% AND ABOVE	UNDER 65%	65% TO 70%	70% AND ABOVE	LOSS	GAIN
Primipara, House	23	14	4	5	12	8	3	7	5
Multipara, House	25	12	4	9	8	4	13	6	11
Primipara, Private	32	16	7	9	19	8	5	7	4
Multipara, Private	20	11	4	5	8	3	9	4	8
Total	100	53	19	28	47	23	30	24	28

TABLE IV. DISTRIBUTION OF CELL VOLUME PER CENT UNDER THIRTY-NINE

		INTRAPARTUM	5 TO 7 DAYS POSTPARTUM
Primipara, House	23	14	12
Multipara, House	25	13	6
Primipara, Private	32	11	14
Multipara, Private	20	9	7
Total	100	47	39

that while normally the circulating blood volume constitutes 8.8 per cent of the body weight, just prior to labor it constituted 9.56 per cent of the body weight. Also that while the average blood loss during labor was only 300 c.c., the average blood volume of twelve patients studied seven to ten days after labor showed a loss of 1100 c.c., and equaled only 9 per cent of the body weight.

Referring again to Tables III and VI, it is noted that 24 per cent showed a loss of 5 per cent in hemoglobin and 18 per cent showed a loss of 200,000 or more red cells. Of the 18 patients showing this loss in red count, 13 were noted to have suffered a blood loss above 300 c.c., or to have been subjected to febrile conditions. Furthermore, in no instance in which fever or blood loss was notable was there a definite increase in hemoglobin, cell volume per cent, or cell count. These two factors appear to be of primary importance in accounting for a qualitative and quantitative reduction in red cells.

To determine the effect of long labor, a tabulation was made of those losing or gaining, who were in labor above the average time of thirteen hours (Table VI). This tabulation indicates that, since only 5 lost while 12 definitely gained, prolonged labor in itself cannot be said to lower the postpartum blood findings. This is surprising when it is remembered that the greater number of operative deliveries fall in the group in whom labor exceeded thirteen hours. On the other hand, low findings at the onset of labor do not appear to have a bearing on the length of labor (Table V). It was found that of those in labor above thirteen hours, the proportion in whom the red count was less than 3.5 million was the same as for the entire series, which is in keeping with frequent clinical observation.

TABLE V. INTRAPARTUM CELL COUNTS

(in millions)

	RANGE IN COUNT				RELATION TO LENGTH OF TIME IN LABOR; I.E., OVER 13 HOURS	
	NUMBER OF PATIENTS	UNDER 3.5	3.5 TO 3.9	4.0 AND ABOVE	UNDER 3.5	3.5 OR ABOVE
Primipara, House	23	10	10	3	5	5
Multipara, House	25	17	5	3	6	1
Primipara, Private	32	14	13	5	2	8
Multipara, Private	20	5	11	4	2	3
Total	100	46	39	15	15	17

TABLE VI. NUMBERS LOSING OR GAINING 200,000 OR MORE CELLS IN FIVE TO SEVEN DAYS

	NUMBER OF PATIENTS	NUMBER LOSING	NUMBER LOSING IN WHOM FEVER OCCURRED OR BLOOD LOSS WAS EXCESSIVE	NUMBER GAINING	NUMBER IN LABOR ABOVE AVERAGE TIME; I.E., 13 HOURS	
					LOSING	GAINING
Primipara, House	23	7	5	6	2	2
Multipara, House	25	4	3	9	1	3
Primipara, Private	32	5	4	11	1	4
Multipara, Private	20	2	1	7	1	3
Total	100	18	13	33	5	12

COMMENT

It must be remembered in an appraisal of the findings in any physiologic state that a fixed standard does not exist. When using the term average normal, the modifying conditions must be given. Many deviations from the usual have been observed incident to pregnancy. As hypertrophy of the uterine wall takes place, there is an increase in vascularization[17] so that the capacity of its vessels is doubled. The dimensions of the heart are enlarged[10] the minute volume output is increased by one-third, and the total circulating blood volume is increased out of proportion to the gain in weight. The reduction of the

circulating blood volume out of proportion to blood loss, and the observation that the hemoglobin, cell volume per cent,[16, 18] and cell count, at the same time increased in spite of blood loss, indicates that low intrapartum findings may, in part, be explained by hydremia. Also some of the tendency toward a rapid rise postpartum may be explained by a loss of fluid constituents of the blood. These considerations, together with the observation that low blood findings do not affect adversely the prospects for satisfactory termination of labor, suggest that it is not an abnormal state, but rather in the terms of Paul Kuehnel, "the physiologic anemia of pregnancy."

In the presence of marked edema the vein and skin puncture hemoglobin readings and cell counts tend to vary. With the disappearance of edema, the hemoglobin and cell counts rise more rapidly than does the cell volume per cent. This observation suggests that lowered clinical findings at the end of pregnancy may, at times, be apparent rather than real.

CONCLUSIONS

From a study of the literature and an analysis of observations on 100 women intrapartum and five to seven days postpartum, the following conclusions are drawn.

1. The red cell count and cell volume per cent, during labor, are definitely lower than the usually accepted average, but the lowered findings in the presence of edema may, in part, be apparent rather than real.

2. If the blood loss in labor is not excessive or the puerperium uncomplicated by fever, the blood values tend to rise by the fifth to seventh day postpartum.

3. Neither social status nor parity affects the averages.

4. It cannot be shown that low blood findings have a bearing on the length of labor, nor that long labor influences unfavorably the findings on the fifth to seventh day postpartum.

REFERENCES

(1) *Osler, William:* Brit. M. J. 1: 1, 1919. (2) *Pepper, O. H. P.:* M. Clin. North America 12: 925-931, 1929. (3) *Peterson, Reuben, Field, Henry Jr., and Morgan, Harold S.:* J. A. M. A. 94: 839-842, 1930. (4) *Osgood, E. E.:* Arch. Int. Med. 37: 685, 1926. (5) *Osgood, E. E., and Haskins, H. D.:* Arch. Int. Med. 39: 643-655, May, 1927. (6) *Gram, H. C., and Norgaard, A.:* Arch. Int. Med. 31: 164, 1923. (7) *Haden, R. L.:* J. A. M. A. 79: 1496, 1922; Arch. Int. Med. 31: 766, 1923. (8) *Kuehnel, Paul:* Geburtsh. u. Gynäk. 90: 511-541, 1927. (9) *DeLee, Jos. B.:* Principles and Practice of Obstetrics, ed. 5. (10) *Williams, J. W.:* Obstetrics, ed. 5. (11) *Bland, P. Brooke, Goldstein, Leopold, and First, Arthur:* Am. J. M. Sc. 179: 48-66, 1930. (12) *Moore, John H.:* Am. J. Obst. & Gynec. 18: 424, 1929. (13) *Kerwin, William, and Collins, Lisle:* Am. J. M. Sc. 172: 548-583, 1926. (14) *Galloway, Chas. E.:* J. A. M. A. 93: 1695-1697. (15) *Lyons, Edward C.:* J. A. M. A. 92: 11-13. (16) *Keith, N. M., Rowntree, L. G., and Geraghty, J. T.:* Arch. Int. Med. 16: 547, 1915. (17) *Beker, J. C.:* Am. J. Obst. & Gynec. 18: 368, 1929. (18) *Keith, N. M.:* Am. J. M. Sc. 165: 174-184, 1923.

808-9 SHARP BUILDING.

INDUCTION OF LABOR BY ARTIFICIAL RUPTURE OF THE MEMBRANES

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ARTIFICIAL rupture of the membranes has long been used as a method to induce labor. However, no critical study of this method has been published. Dr. J. M. Slemons in a personal communication to Dr. J. W. Williams wrote enthusiastically of his experiences in private practice with the rupture of the membranes for the induction of labor, and at Dr. Williams' suggestion, our study was undertaken. This study is particularly timely, since Dr. Morton[1] in December, 1929, published in this JOURNAL an analysis of the experience of the Hopkins Clinic with both the bag and bougie in the induction of labor. It is therefore possible to compare the results obtained by rupture of the membranes with those by means of the bag and bougie in the same clinic material.

The first part of our material was made up of women with normal pregnancies who presented themselves in the dispensary at or near term. They were then sent into the hospital and observed for twenty-four hours to be certain they were not in labor. Rupture of the membranes was done in these first cases to excite pains. When we had sufficiently demonstrated the usefulness of the membrane rupture method to induce labor in normal cases, abnormal cases were added to our material; namely, those in which it was advisable to end the pregnancy because of a toxemia, pyelitis, tuberculosis, or cardiac condition, as well as for postmaturity in normal women. However, we largely restricted the study to the induction of labor in term pregnancies, the method being used only to induce one abortion and four premature labors. The method was studied in 120 cases, 115 being term pregnancies. Of the 120 cases, 70 per cent were white and 30 per cent colored.

We employed three variations of the same method. In series "I" we gave the patients one ounce of castor oil with ten grains of quinine, repeating the dose of quinine after intervals of one and two hours. Two hours later a hot soapsuds enema at 115° F. was given. Four hours after the castor oil had been given, the patient was taken to the delivery room and the membranes ruptured. This was immediately followed by an ampule of pituitrin applied intranasally, according to the method of Hofbauer.[2] The pituitrin was reapplied each

hour until strong pains began. In series "II," we gave the castor oil and quinine exactly as in series "I," and the membranes were ruptured after a similar time interval, but no pituitrin was given. In series "III," we ruptured the membranes without giving preliminary castor oil and quinine, and also without pituitrin.

Technic of Rupturing Membranes.—The patient was shaved and placed in the lithotomy position, the legs being held in stirrups. The perineum was painted with two coats of an acetone-alcohol solution of 2 per cent mercurochrome. One ounce of 4 per cent aqueous mercurochrome was instilled into the vagina. The patient was then examined and the length of the cervical canal and the degree of dilatation of the internal os estimated. The presenting part was palpated and its engagement noted. When the internal os was closed, the index finger was introduced and rotated carefully as a dilator until the tip of the finger could be passed through the internal os. A membrane hook was then passed up along the finger and the membranes were ruptured by allowing the back of the hook to rest parallel to the flexor surface of the finger. Then, by flexing the finger, the hook was made to spear the membranes. In some patients in whom the internal os was already sufficiently dilated to admit one finger, the cervix was further dilated digitally to admit two fingers and the membranes then ruptured. This was done for two reasons: in the first place, we had found from our experience that the membranes could be more easily ruptured if two fingers were introduced and the membrane hook guided between the fingers. In the second place, we thought that this more extensive dilatation of the cervix would hasten the onset of labor and possibly shorten its course. After the membranes were ruptured, the hand was withdrawn and the amount of amniotic fluid expelled was carefully estimated, or, when possible, measured. In many cases, the head was lifted up to allow the escape of more fluid, so that the initial fluid loss could be correlated with the efficiency of the induction. The patient was then returned to the first stage room, where she was kept in bed. Following this, no sterile perineal towel or pad were worn. In none of our cases was there any bleeding following these procedures, which demonstrates that our manipulations did not injure the cervix.

In most patients the rupture of the membranes can be done without the use of a general anesthetic; however, in about one-fifth of the cases an anesthetic was necessary, particularly in primiparae with a closed internal os. Patients in whom "forewaters" were scanty also presented difficulties. In these it was often necessary to push the head up a centimeter or two before rupturing the membranes, for the purpose of avoiding injury to the infant's scalp when spearing the closely applied membranes, although we never met with such an accident. When gas-oxygen anesthesia was used, we were able to rupture the

membranes in every case. In all instances it was done solely with the use of the finger and the membrane hook.

General.—Following the rupture of the membranes, all of our patients went into labor, the longest interval between the rupture of the membranes and the onset of regular labor pains, which we have designated the "latent period," being fifty-two hours. When using either the bag or bougie, it has been customary in order to prevent infection, to remove them after twenty-four hours if labor had not commenced; and accordingly the number of successful inductions with these methods have been figured on the basis of the number of cases in which labor began within twenty-four hours of their introduction. Of the 120 cases we report, only 6, or 5 per cent, had latent periods of twenty-four hours or more. In figuring the percentage of success with the other two methods, Morton considered the case successful even if repeated introductions of the bag or bougie were necessary to finally induce labor; all the separate attempts being summarized as one successful case. Using Morton's criterion of successful cases, the membrane method gave 95 per cent, the bougie 88.2 per cent, and the bag 95.8 per cent in term cases. To be sure, the criterion of a latent period of less than twenty-four hours for a successful induction is not necessary in considering cases induced by rupture of the membranes; as the case with the longest latent period of fifty-two hours was delivered spontaneously of a living child after a total labor of one hour and forty minutes. In addition, the puerperium was afebrile. However, there is a definite relationship between the time elapsing from the rupture of the membranes to the onset of labor, with the development of purperal infection. In the 18 cases with a latent period of more than four hours before the onset of labor following the rupture of the membranes, there was an infection rate of 28.8 per cent; while in the 102 cases with a latent period of four hours or less, it was 6.86 per cent.

Since all of our cases went into labor spontaneously following rupture of the membranes, does this mean that we consider the method 100 per cent successful?

The following 3 cases had very unsatisfactory labors, although it is uncertain whether the method of induction was in any way contributory. In one case, Unit 10,188, a para xii, eleven children living, two miscarriages, there was a latent period of forty-eight hours, and the labor pains were of very poor quality. The patient developed an intrapartum infection which killed the baby. The labor was finally ended after forty-eight hours by manual dilatation of the cervix from 7 cm. and craniotomy upon the dead child. It is worthy of note that in her preceding pregnancy the patient had a similar labor with a similarly torpid uterus. At that time the membranes had ruptured spontaneously before the onset of pains, and castor oil, quinine and pituitrin were given without exciting labor. Finally, after sixty

hours, the last few of which were occupied by indifferent labor pains, the cervix was manually dilated from 7 cm. and a stillborn infant delivered by version. In patient Unit 25,611, a para v, there was a latent period of forty-two hours. This patient also developed an intrapartum infection, and since labor pains were poor, a bag was inserted to hasten delivery. She was delivered by mid-forceps of a good baby, after a labor of twelve and one-half hours. In the third case, Unit 13,280, a para ix, the bag also had to be used to hasten labor. Membranes were ruptured and labor began after an eight and three-fourths hours latent period. Pains were very poor, and the uterus was atonic and flabby. The fetal heart became irregular and rapid. A bag was inserted to hasten labor on behalf of the child, and a living infant was delivered spontaneously after a labor of four hours and thirty-five minutes. In none of these three cases can it be definitely proved that the artificial premature rupture of the membranes in any way influenced the course of labor; however, it is possible. In the other 117 cases, the labors were quite normal. It is important to note that in the 3 unsatisfactory cases we had to deal with women who had borne many children and in whom the uterus was atonic. It is possible that after a more extensive study, such a history may be found to offer a contraindication to this method of induction; but, on the other hand, we had nine cases in women who had borne 5 or more children in whom labor was completely satisfactory.

Comparison of the Three Variations of Method.—The comparative value of the three variations of membrane rupture technic was studied. For this purpose we took 30 consecutive cases for an initial study. To the first 10 we gave castor oil and quinine, ruptured the membranes artificially four hours later, and then gave intranasal pituitrin at hourly intervals until labor pains had become established. To the second group of 10 we gave the preliminary castor oil and quinine, and ruptured the membranes four hours later. In the third group, we ruptured the membranes without using any preliminary or subsequent medication.

In studying these three groups, we compared the latent period in

TABLE I. PRIMIPARAE

METHOD	NO. OF CASES	*Latent Period* TIME IN HOURS FROM RUPTURE OF MEMBRANES TO ONSET OF LABOR	TOTAL LENGTH OF LABOR IN HOURS
Castor Oil-Quinine— Rupture of Membranes— Pituitrin	28	Avg. 1.8 Hr.—Mean 0.93 Hr.	10.01
Castor Oil-Quinine— Rupture of Membranes	25	Avg. 2.5 Hr.—Mean 1.8 Hr.	10.08
Rupture of Membranes Alone	8	Avg. 5.69 Hr.—Mean 5.69 Hr.	11.99

each; that is, the time interval from the rupture of the membranes until the onset of regular pains, and also the duration of labor. These small series demonstrated that the last method was not nearly as efficient as either of the other two. We therefore eliminated that method from the rest of the study, and increased the number of cases with the other two methods. Labor was induced in 54 cases by castor oil, quinine, rupture of the membranes and pituitrin; and in 55 by castor oil, quinine, and rupture of the membranes without pituitrin. In Table I, the latent periods and length of labor of the three methods is given separately for primiparae and multiparae.

TABLE II. MULTIPARAE

METHOD	NO. OF CASES	Latent Period TIME IN HOURS FROM RUPTURE OF MEMBRANES TO ONSET OF LABOR	TOTAL LENGTH OF LABOR IN HOURS
Castor Oil-Quinine— Rupture of Membranes— Pituitrin	26	Avg. 3.8 Hr.—Mean 1.49 Hr.	3.29
Castor Oil-Quinine— Rupture of Membranes	30	Avg. 4.2 Hr.—Mean 0.9 Hr.	7.13
Rupture of Membranes Alone	2	Avg. 27.5 Hr.—Mean 27.5 Hr.	8.00

In other words, it appears that the latent period was markedly shortened by preliminary castor oil and quinine, but was apparently little influenced by the use of intranasal pituitrin.

In these cases with premature artificial rupture of the membranes, it is apparent that the length of labor is but little influenced by preliminary castor oil, quinine or pituitrin, except perhaps in multiparae. In the latter, the length of labor was only one-half as long when pituitrin was given.

Length of Labor and Percentage of Spontaneous Deliveries.—It is important to ascertain if the artificial rupture of the membranes used to induce labor influences the length of the labor; and to our surprise Table III shows, in our limited series of cases, that the procedure materially shortened the total length of labor, decreasing it by 73.3 per cent in primiparae, and by 116.4 per cent in multiparae.

TABLE III. LENGTH OF LABOR

AVERAGE LENGTH OF TERM LABOR IN PATIENTS INDUCED BY ARTIFICIAL RUPTURE OF MEMBRANES	AVERAGE LENGTH OF LABOR AT TERM IN 14,396 CASES —HOPKINS HOSPITAL
Primiparae (61 Cases) 10.15 Hours	17.59 Hours
Multiparae (58 Cases) 5.43 Hours	11.75 Hours

This striking decrease in the duration of labor is due to a shortening of both the first and second stages, since the average second stage in the primiparae of our series was 0.97 hour, as compared with the

usual 1.75 to 2.0 hours; while in the multiparae it was only 0.41 hour. The third stage lasted 0.24 and 0.20 hour in the primiparae and multiparae, respectively.

One hundred and three, or 83.5 per cent of the patients were delivered spontaneously. Among the 17 operative deliveries, there were two breech extractions. This incidence of spontaneous delivery compares favorably with that noted in our entire clinical material, in which 81 per cent of 14,396 full-term patients were delivered spontaneously. It is important to determine, if possible, whether the shortening of the length of labor was due primarily to rupturing the membranes artificially before the onset of labor, or to some other factor. There are two factors which might contribute to this result; namely, the birth of small children, or an unusually high incidence of normal pelves.

The average child in our series of primiparae weighed 3226.3 gm. at birth, which approximates closely the expected average figure for infants of whom 36 per cent are colored. The average child of the multiparae weighed 3487.6 gm., of which 22.4 per cent were colored. This conclusively shows that the small size of the children could not explain the marked decrease in the length of labor.

Of the 84 white women in our material, 13 had contracted pelves of moderate degree, an incidence of 15.4 per cent; as compared with 9, or 25.7 per cent in 35 negroes. Upon comparing these figures with those noted in 15,109 consecutive patients in our Clinic, with an incidence of 19.76 and 45.6 per cent in the white and black patients, respectively, it is seen that the gross incidence of contracted pelvis was somewhat below the average; but this may be accounted for in part by the fact that less than 30 per cent of the patients in the present series were black, instead of approximately equal numbers of the two races in the larger series. In addition, many of the patients with contracted pelves in the larger series were delivered by cesarean section, which would lower considerably the percentage of contracted pelves in full-term vaginal deliveries which our material represents. We are therefore safe in assuming that most of the decrease in the length of both the primiparous and multiparous labors in our series of 119 cases was due primarily to the induction by premature artificial rupture of the membranes.

Analysis of Some Other Factors Influencing the Length of Labor, the Latent Period, and the Character of the Labor Pains.—We analyzed the relation of the amount of fluid lost at the time of the rupture of the membranes to the length of the latent period, the duration of labor, and the character of labor pains. Our results showed no uniformity and consequently we are unable to establish any correlation between them.

Likewise, we could establish no relationship between the weight of the child and the latent period; nor did the weight of the child appear

to have any effect upon the length of labor. The expected date of confinement showed no clear-cut relationship to the latent period nor to the length of labor. Those patients in whom labor was induced two weeks before the expected term date seemed just as likely to have a short latent period and short labor as those two weeks past term.

We were interested to learn whether the length of the cervix or its degree of dilatation at the time of induction affected either the latent period or the duration of labor.

TABLE IV

PRIMIPARAE		MULTIPARAE	
DILATATION OF CERVIX IN CM.	LATENT PERIOD IN HR.	DILATATION OF CERVIX IN CM.	LATENT PERIOD IN HR.
Closed	2.44	Closed	6.9
1-2	1.87	1-2	3.26
2 +	1.12	2 +	0.46

Upon studying our data it was found that in both primiparae and multiparae the degree of dilatation of the cervix directly affected the latent period. In the primiparae with the cervix closed it averaged 2.44 hours, as compared with 1.87 and 1.12 hours when the cervix was dilated 1.0 to 2 cm., or was still more patent, respectively. In multiparae an even more marked correlation was noted, since those with an undilated cervix before the onset of labor had an average latent period of 6.9 hours, those with a cervix 1.0 to 2 cm. 3.26 hours, and those with still greater dilatation only 0.46 hour. This particular factor seems to be of extreme importance in separating those cases with long latent periods from those with short latent periods in both the primiparae and multiparae. Another way of demonstrating this same relationship is to consider separately all patients with latent periods of four hours or more and to compare their cervical dilatation with that noted in patients with a latent period of one hour or less. In 20 patients in the first group the average cervical dilatation was 0.95 cm. at the time the membranes were ruptured; whereas in the second group it was 1.58 cm. To be sure the degree of cervical dilatation does not permit an infallible prognosis as to the length of the latent period, since there were several exceptions to the general rule. On the other hand, it is important to emphasize the fact that the average amount of cervical dilatation at the time of the rupture of the membranes bears no relationship to the duration of labor.

Analysis of the length of the cervix at the time of the induction reveals some interesting positive results, and Table V indicates that in general the latent period becomes longer with increased length of the canal.

Thus, in the last group in Table V, which represents only 17 per cent of the primiparae, we find that the latent period lasted four hours

TABLE V

PRIMIPARAE		MULTIPARAE	
LENGTH OF CERVICAL CANAL IN CM.	LATENT PERIOD IN HR.	LENGTH OF CERVICAL CANAL IN CM.	LATENT PERIOD IN HR.
0.5-1	1.74	0.5-1	4.47
1.5-2	1.53	1.5-2	3.32
2.5-3	1.73	2.5-3	5.25
3.5-4	6.22		

or more in one-half of the patients; and in multiparae there is a similar relationship. The length of the cervix at the time of the induction of labor can also be correlated with the length of the labor. Table VI shows clearly that the longer the cervix at the time the membranes are ruptured, the longer labor will be in both primiparae and multiparae.

TABLE VI

PRIMIPARAE		MULTIPARAE	
DURATION OF LABOR IN HR.	AVERAGE LENGTH OF CERVIX IN CM.	DURATION OF LABOR IN HR.	AVERAGE LENGTH OF CERVIX IN CM.
Less than 8	1.66	Less than 3	1.68
8-16	2.21	3-6	1.65
16 +	2.56	16 +	2.43

To summarize our findings, it may be stated that there is no constant relationship between either the amount of fluid lost at the time of the rupture of the membranes, the expected date of confinement, or the size of the child, with either the length of the latent period or the duration of labor. The character of the labor pains seemed in no way related to the amount of fluid drained off at the time of induction. The latent period, however, was definitely shorter in both primiparae and multiparae who had a short cervix, and also in whom the cervix was 2 cm. or more dilated at the time of the induction than in others. The length of the labor seemed unaffected by the degree of dilatation of the cervix, but it was influenced by its length. The labors were definitely shorter in the patients in whom the cervical canal was short at the time of the rupture of the membranes.

Morbidity.—Twelve of the 119 patients had febrile puerperia (a rise to 100.4° F. or more on any two days after the first) due to infection; giving a maternal morbidity from this cause of 10.08 per cent. In addition, there were 3 cases in which pyelitis was the indication for induction, and also one case of postpartum mastitis. Including these complications, we have an uncorrected gross maternal morbidity of 13.44 per cent. The only comparable figures at our disposal are those of the Woman's Clinic of the Johns Hopkins Hospital for all term deliveries from 1923 to 1928. (Table VII.)

To be sure, our series is not entirely comparable with our general clinical material. In the first place, 80 per cent of our patients received vaginal instillations of mercurochrome during the course of

TABLE VII

SOURCE OF MATERIAL	BLACKS		WHITES	
	PUERP. INF.	FEB. OTHER CAUSES	PUERP. INF.	FEB. OTHER CAUSES
Hopkins 1923 to 1928	27.0%	4.8%	14.4%	4.5%
119 Cases of Induction by Rupture of Membranes	11.4%	3.6%	9.4%	3.4%

their labor, and as yet, there are no corresponding figures available for our general material; but at least it can be said that this method of inducing labor has not led to any increase in morbidity. In addition, as we said before, our cases represent a selected group, especially as it contained fewer blacks than usual, with their relatively high incidence of contracted pelves. There were 4 cases in the 119 of intrapartum infection (a rise of 100.4° F. or more during the course of the labor), which gives an incidence of 3.36 per cent; but unfortunately there are no figures from our Clinic with which this may be compared.

Maternal and Fetal Mortality.—There were no maternal deaths in our series of induction of labor by premature rupture of the membranes. There were 7 fetal deaths, or a neonatal mortality of 5.88 per cent; one of these was a premature infant, giving a term fetal death rate of 5.08 per cent. This compares satisfactorily to a neonatal mortality of 5.16 per cent in the last 14,316 term deliveries in our service.

Herewith follow the protocols of each fetal death:

(1) Unit 24,630. Primipara. Marked hydramnios. After artificial rupture of the membranes, compound presentation, prolapse of cord. Bag inserted. Child weighed 3,260 gm. Delivered spontaneously; stillborn. Autopsy refused.

(2) Unit 10,133. Multipara. Long latent period. Long labor. Uterine inertia. Intrapartum infection with death of child. Delivered by craniotomy. Autopsy: Extreme maceration. Craniotomy term child.

(3) Unit 16,665. Multipara. Child died twelve hours postpartum. Weight 4,085 gm. Autopsy: Congenital abnormality of pulmonary artery; patent ductus arteriosus; hypertrophy of right ventricle; patent foramen ovale; defect of interventricular septum.

(4) Unit 25,354. Primipara. Child weighed 2,590 gm., and died on the ninth day. Autopsy: Congenital syphilis (?); hemorrhagic disease of newborn; bronchopneumonia left base; patent ductus arteriosus; fresh blood over surface of brain.

(5) Unit 25,957. Primipara. Child weighed 2,820 gm. Spontaneous delivery. Labor twenty-five hours. No clinical cause for death. Autopsy: Patent ductus arteriosus; patent foramen ovale; not known whether lesion was severe enough to be incompatible with life.

(6) Unit 26,173. Primipara with generally contracted typical pelvis. Labor thirty hours, ended by low forceps. Child weighed 3,500 gm. Biparietal 9 cm. Child apparently in good condition when forceps were applied. Difficulty in extraction. Autopsy: Moulding of head; petechial epicardial hemorrhages.

(7) Unit 25,956. Primipara. Premature infant (2,350 gm.). Labor twenty-five and three-quarters hours. Spontaneous delivery. Child died twelve hours postpartum. Autopsy: Premature infant; hemorrhages into epicardium, thymus and falx cerebri.

After studying the above protocols, we can accept responsibility for only two deaths. The patient with hydramnios (Case 1), might have had a similar outcome if she had been allowed to rupture her membranes spontaneously. It is quite possible that with such marked hydramnios a compound presentation would have developed with prolapse of the cord. In Case 2, with atony of the uterus and intrapartum infection, the outcome might have been the same had labor not been induced, since in her previous spontaneous delivery she had similar atony with intrapartum infection and intrauterine death. The other 5 deaths probably would have occurred if labor had been induced or not.

Comparison of the Bag, Bougie, and Rupture of the Membranes.—We reprint Morton's Table VIII for the comparison of the bag and bougie. To this, we have added a third column for the membrane rupture method.

TABLE VIII

	BOUGIE		BAG		RUPTURE OF MEMBRANES	
	CASES	PER CENT	CASES	PER CENT	CASES	PER CENT
General:						
1. Total number of cases	160		49		120	
2. Successful cases	132	82.5	46	93.8	120	100.0
3. Spontaneous deliveries	96	72.7	27	58.8	103	83.5
4. Expectancy of spontaneous delivery within twenty-four hours		59.6		55.1		83.5
5. Breech presentation	3	2.3	7	15.2	2	1.66
Fetal Mortality:						
1. Gross mortality	18	18.1	15	46.9	7	5 88
2. Mortality minus operative mortality	15	15.06	10	31.2	6	5.08
3. Mortality minus operative with toxemia mortality	4	4.0	6	18.7	4	3.36
Maternal Morbidity and Mortality:						
1. Morbidity	34	18.6	17	37.7	16	13.44
2. Mortality, obstetric	2	1.3	1	2.1	0	0
Prolapsed Cord:						
1. Total number incidence	6	4.5	8	17.4	1	0.84
2. Stillborn babies	2		6		1	

A study of Table VIII item by item reveals the unquestioned superiority of the membrane rupture method over the bag or bougie. It seems so conclusive that it leaves little room for doubt. It is important for others to publish similar comparisons to determine whether our series is an especially fortunate one, or whether such results can be obtained generally.

Comparison of Artificial and Spontaneous Premature Rupture of the Membranes.—In order to make our study more complete, we selected 100 consecutive cases entering the hospital in whom the membranes had ruptured spontaneously before the onset of labor. Table IX compares this series of 100 cases with the 119 cases we induced by artificially rupturing the membranes.

TABLE IX

	NO. OF CASES	AVER. LATENT PERIOD—HR.		AVER. LENGTH TOTAL LABOR		AVER. LENGTH SECOND STAGE		TERM NEONATAL MORTALITY PER CENT	INTRA-PARTUM INF. PER CENT	PUERPERAL INF. PER CENT	SPONT. DELIVERIES PER CENT	CONT. PELVES PER CENT
		PRIM.	MULT.	PRIM.	MULT.	PRIM.	MULT.					
Artificial Rupture	119	2.14	4.01	10.15	5.43	0.97	0.24	5.08	3.36	10.08	83.5	18.48
Spontaneous Rupture	100	8.84	8.25	11.2	7.0	1.01	0.53	5.0	8.0	11.0	78.0	19.0
14,396 Consecutive Deliveries Johns Hopkins Hospital	14,396			17.59	11.75	*1.75+	*1.0	5.16		20.7	81.0	32.68

*Figures taken from Williams' Obstetrics, Appleton, 1925.

Upon analyzing Table IX, it is evident that the latent period is much more prolonged in the spontaneous group. In fact, it is four times longer in the primiparae, and more than twice as long in the multiparae than in our series. The probable reasons for this discrepancy are, first, that the uterus in the spontaneous group was not sensitized by preliminary castor oil and quinine; and second, to the absence of intracervical manipulation.

The length of labor in the two groups is practically the same, but if anything somewhat shorter in patients in whom the membranes were ruptured artificially. Upon combining these two groups of 219 patients in which the membranes were ruptured before the onset of labor, it is clear that in them the duration of labor is at least not lengthened. In fact, upon comparing the 119 primiparae in these two groups with the average length of labor noted in the Clinic, we see that the latter was 65.1 per cent longer. In multiparae, the difference is even more marked, since the average length of labor is 93 per cent longer in the other clinic patients. This unexpected difference is in agreement with the experience of Schultze[3] of the University of California. In our experience labor is shortened in both the first and second stages by premature rupture of the membranes. Contributory factors to this decrease in our series may be the relatively low incidence of contracted pelves and the absence of elderly primiparae.

As shown in Table IX, the gross term neonatal mortality appears to be uninfluenced by premature rupture of the membranes.

The incidence of intrapartum infection is much lower in the artificially ruptured group, and is probably explained by their much shorter latent period and somewhat shorter labor. The puerperal infection rate was halved in our 219 cases of ruptured membranes when compared with the total rate in the Clinic from 1923 to 1928. This is unquestionably due to a number of factors. One of importance is that our ruptured membrane group represents a somewhat special group of cases, since no cases neglected or infected on admission were included in it. Likewise, we feel that the shortening of labor is an important factor in lowering the incidence of intrapartum and puerperal infection. It is interesting to note that the vaginal examination and cervical manipulation necessary to rupture the membranes apparently did not increase the incidence of infection.

CONCLUSIONS

1. Labor at or near term can be successfully induced by artificial rupture of the membranes. The efficiency of this method is increased by the preliminary administration of castor oil and quinine.

2. In our experience this method is superior to both the bag and bougie.

3. This technic has decreased the average length of labor, lessened the incidence of puerperal infection, and did not affect the neonatal mortality.

REFERENCES

(1) *Morton, D. G.:* Am. J. Obst. & Gynec. 18: 849, 1929.   (2) *Hofbauer, I.:* Am. J. Obst. & Gynec. 14: 137, 1927.   (3) *Schultze, Margaret:* Am. J. Obst. & Gynec. 17: 20, 1929.

Laffont, Houel, and Ferrari: Seven Cases of Ligation of the Vena Cava. New Observations on Suppurative Utero-Pelvic Phlebitis. Bull. Soc. d'obst. et de gynéc. 17: 373, 1928.

The authors are convinced that in the treatment of obstetric pelvic infections, ligation of the vena cava and the utero-ovarian pedicles is the best treatment. If these ligations appear to be insufficient, further operations are performed, such as resection of the utero-ovarian pedicles and hysterectomy either total or subtotal. Vaginal drainage is instituted in these cases. Among the 9 cases thus treated, 3 died.

J. P. Greenhill.

Chydenius, J. J.: The Operative Treatment of Generalized Abortal Peritonitis. Acta obst. et gynec. Scandinav. 10: 1, 1930.

During the last ten years there were 56 cases of generalized peritonitis following abortion at the Helsingfors gynecologic clinic. Chydenius found that all but one of the 27 patients who were not operated upon died. Of the 29 operated women, 10 recovered. Up to 1926 the operations consisted of laparotomy and simple drainage of the abdominal cavity. Of the 13 women subjected to this type of operation 11 died. After 1926 the operations were much more radical and in most cases the uterus and adnexa were removed by laparotomy and both vaginal and abdominal drainage were instituted. Of the six patients operated upon in this manner 2 recovered. In 10 cases where the pelvic cavity after drainage into the vagina was separated from the abdominal cavity by the sigmoid, there were 6 recoveries.

J. P. Greenhill.

Harris, J. W., and Brown, J. H.: The Bacterial Contents of Vagina and Uterus on the Fifth Day of the Normal Puerperium. Bull. Johns Hopkins Hosp. 43: 190-200, 1928.

In thirty uteri cultured on the fifth day of the normal, afebrile puerperium only 10 were found sterile, but none contained streptococci.

Vaginal cultures taken at the same time showed the presence of aerobic and anaerobic alpha and gamma streptococci in 24 of the 30 patients; but the aerobic, beta-hemolytic streptococcus, which is the etiologic factor in the majority of fatal cases of puerperal infection, was not present in any of the patients studied.

C. O. Maland.

THE CERVICAL CESAREAN SECTION*

A Report on the End-Results of 418 Consecutive Operations

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THE cervical cesarean section has received increasingly favorable consideration, both in this country and abroad, during the last fifteen years. In a number of American clinics it is gradually replacing the classical type. The names of several obstetricians, who have modified the method in some of its details, have become attached to the operation. The use of these names greatly adds to the confusion which already exists.

Anatomically, the lower uterine segment may be reached by one of three methods in performing cesarean section. (1) The extraperitoneal approach represented by the method of Latzko. (2) The transperitoneal approach illustrated by the procedure of Veit-Fromme-Hirst, where the visceral and parietal layers of peritoneum are united by sutures, thus creating a so-called extraperitoneal space. (3) The intraperitoneal approach where the peritoneal cavity is opened by a longitudinal suprasymphyseal incision, the bladder separated from the lower uterine segment and an incision made in it for delivery. The intraperitoneal operation may be practiced in one of two ways, (1) with a longitudinal cervical incision and (2) with a transverse cervical incision. The cervical incision, in either case, is covered over by the bladder and becomes retrovesical, subperitoneal, or retroperitoneal.

I have personally performed 418 cervical cesarean sections using the four methods according to Table I.

TABLE I. TYPE OF OPERATION

Total number of cervical cesarean sections	418
Extraperitoneal (Latzko)	2
Transperitoneal (Veit-Fromme-Hirst)	58
Intraperitoneal (Longitudinal cervical incision, Krönig)	160
(Transverse cervical incision)	198

I have done the last 198 cervical cesarean sections with a transverse incision which curves upward and which is placed as low down as possible in the lower segment, my own modification of the operation.

The 418 operations were performed in 31 hospitals varying in equipment from that of the large metropolitan hospital where a separate operating room is reserved for cesarean sections to that of the small town hospital where all surgery, clean and septic, including cesarean section is done in the same operating room. The after-care in the out-of-town cases was carried out by the family physician.

In analyzing my series of 418 cervical sections I shall, for the sake of clearness, use the anatomical classification described above.

TABLE II. NUMBER OF PREGNANCIES

| | EXTRA-PERITONEAL | TRANS-PERITONEAL | INTRAPERITONEAL | |
			LONGITUDINAL INCISION	TRANSVERSE INCISION
Para i	1	41	63	87
Para ii		11	45	52
Para iii			27	28
Para iv		3	13	15
Para v		1	7	7
Para vi		1	1	3
Para vii		1	2	2
Para viii			1	
Para ix			1	2
Para x	1			1
Para xi				1
Total	2	58	160	198

TABLE III. LABOR

| | EXTRA-PERITONEAL | TRANS-PERITONEAL | INTRAPERITONEAL | |
			LONGITUDINAL INCISION	TRANSVERSE INCISION
Test of labor	2	40	44	68
No labor	0	18	116	130
Total	2	58	160	198

EXTRAPERITONEAL

Two patients had labor, in one the hours were not determined, the cervix was fully dilated. The second was in labor thirty-six hours.

TRANSPERITONEAL

The 40 patients who had labor had the following number of hours: 72, 67, 48, 36—2 patients; 35, 34, 24—7 patients; 20, 18, 17, 16—2 patients, 14—2 patients, 12—2 patients, 6, 5, and 4 hours. In the other 14 patients who had labor the number of hours were not determined.

INTRAPERITONEAL

Longitudinal Incision

The 44 patients who had labor had the following number of hours: 72, 36, 26, 24—5 patients; 17, 16, 12—6 patients; 10, 8, 6—2 patients, and 3 hours. In the other 23 patients who had labor the number of hours were not determined.

Transverse Incision

The 68 patients who had labor had the following number of hours: 72—2 patients; 64, 48—2 patients; 36, 30—2 patients; 24—3 patients; 21, 20—4 patients;

19½, 17, 16—4 patients; 15½, 15—3 patients; 14½, 14—3 patients; 13—2 patients; 12½—2 patients; 12—7 patients; 11—2 patients; 10—2 patients; 9, 8—6 patients; 7½, 7, 6—3 patients; 5—2 patients, and 4 hours. In the other 8 patients who had labor the number of hours were not determined.

TABLE IV. MEMBRANES

| | EXTRA-PERITONEAL | TRANS-PERITONEAL | INTRAPERITONEAL | |
			LONGI-TUDINAL INCISION	TRANSVERSE INCISION
Membranes ruptured	1	7	11	22
Membranes intact	1	51	149	176
Total	2	58	160	198

EXTRAPERITONEAL

In one woman the membranes had been ruptured many hours; in the other they were intact.

TRANSPERITONEAL

In the cases of the parturient patients where the membranes had ruptured, they had had long labors and the membranes had been ruptured many hours.

INTRAPERITONEAL

Longitudinal Incision

The membranes were ruptured ten hours in one, 6 hours in another, number of hours not determined in nine.

Transverse Incision

The membranes in 22 patients had been ruptured the following number of hours—72, 48—3 patients; 30½, 30, 24, 21, 19, 18, 15, 14, 12, 8, and 3 hours. Hours not determined in 7.

TABLE V. CERVICAL DILATATION

EXTRAPERITONEAL

Cervix fully dilated	2

TRANSPERITONEAL

Cervix fully dilated	7
Cervix half dilated	6
Cervix one quarter dilated	9
Cervix slightly dilated	15
Cervix not dilated	21

INTRAPERITONEAL

Longitudinal Incision

Cervix fully dilated	3
Cervix dilated to admit 3 fingers	1
Cervix dilated to admit 2 fingers	6
Cervix dilated to admit 1 finger	5

In the other 29 patients who had labor the amount of cervical dilatation was not determined.

Transverse Incision

Cervix fully dilated	8
Cervix half dilated	2
Cervix one-third dilated	1

In the 57 other gravid women who had labor the dilatation varied from no dilatation to dilatation to admit 4 fingers.

TABLE VI. VAGINAL EXAMINATIONS

EXTRAPERITONEAL	
Several vaginal examinations	2
TRANSPERITONEAL	
Several vaginal examinations	5
Two vaginal examinations	4
One vaginal examination	1

Of the 58 cases 10 had vaginal examinations. All these examinations were done outside, before admission to the hospital.

INTRAPERITONEAL	
Longitudinal Incision	
Several vaginal examinations	4
Two vaginal examinations	1
One vaginal examination	3

One of these vaginal examinations was performed in the hospital, the others before admission to the hospital.

Transverse Incision	
Three vaginal examinations	1
Two vaginal examinations	1
One vaginal examination	4

One parturient patient had a sixty-four hour labor followed by a trial high forceps. Since it was impossible to bring down the head with moderate traction she was delivered by a transverse cervical cesarean section, the placenta and membranes being delivered through the vagina. She had an afebrile puerperium and had no postoperative complications.

All labors in the author's practice are conducted by rectal examinations, hence the small number of vaginal examinations.

Nine puerperae had septic uteri with uteroabdominal fistulas, discharging pus freely through the vagina and through the abdominal incision. All wounds were irrigated with a chlorine solution. All the patients recovered. None developed peritonitis. This group tends to prove that the union of the visceral and parietal peritoneum in the transperitoneal operation offers a definite protection against peritonitis.

CASE I.—Para i. Abruptio placentae, packed twice, once in her home, attempts at manual dilatation before admission.

CASE II.—Para i. Admitted after thirty-five hours of labor with a floating head and ruptured membranes. This case was one of extreme sepsis, the whole cervical incision broke down and one could introduce the sterile fingers through the abdominal opening into the fundus as well as into the cervix. She had an elevation of temperature from 102° F. to 105° F., with a pulse rate of 130 to 150 for twenty days. On the twentieth day her hemoglobin was 30 per cent, and she was given a blood transfusion on this day. She left the hospital on the fifty-second day with a healed incision and in good health. The impressive fact about this case was that while pus was pouring freely from the broken-down cervical incision there was not the least sign of peritoneal irritation, the bowels and bladder functioned normally and she experienced no abdominal symptoms.

CASE III.—Para i. Right occipitoposterior, floating head, long labor, vaginal examinations outside.

CASE IV.—Para i. Right occipitoposterior, floating head, few hours of labor, intact membranes, no vaginal examinations. This might have been considered an ideal case for the classical operation.

CASE V.—Para i. Short test of labor, breech left sacroposterior, neurotic woman, no progress, intact membranes, no vaginal examinations. This case might also have been considered in an ideal condition for the classical operation.

CASE VI.—Para i, elderly, in labor a number of hours before admission, no engagement, intact membranes, eczema of the vulva, no vaginal examinations.

CASE VII.—Para i, admitted with the cervix fully dilated, no engagement, membranes intact, no vaginal examinations.

CASE VIII.—Para i, very stout woman in labor sixty-seven hours, no engagement, cervix fully dilated, membranes ruptured, one vaginal examination in her home before admission, uterus contracted, meconium in utero, vertex presentation, fundal myoma.

CASE IX.—Para i. Rigid cervix, labor 36 hours, membranes ruptured at onset of labor, maternal exhaustion, no engagement.

These nine women with septic, broken-down cervical incisions were prevented from having septic general peritonitis by the protection offered by the united peritoneal layers. They all recovered and were discharged with healed incisions. One of the patients, Case 1, who was operated upon later by the Krönig method, showed a perfectly healed cervix. Another, Case 4, was subsequently delivered in another clinic by a classical section and no weak point was found in the lower segment. Still another patient, Case 9, is pregnant at the present time. Two of the patients fulfilled the indications for the classical cesarean section, that is, just enough labor to dilate their cervices for drainage, intact membranes, never examined vaginally during pregnancy and labor, and yet I am convinced that they would have died of peritonitis had the latter operation been performed. The cases may explain the occasional case of peritonitis following the classic operation, where apparently all indications have been fulfilled. Seven of the cases were considered potentially infected.

Six patients had mild uterine sepsis with a temperature of 101° F., they had no abdominal complications and they all did well.

The following conditions were also responsible for the morbid state, bilateral mammary abscesses: bronchopneumonia occurring in two patients, bilateral thrombophlebitis and acute arthritis of both knee joints (this patient remained in the hospital for two and a half months at which time she was discharged well), superficial infection of the abdominal incision occurring in two patients, an abscess between the cervix and the abdominal wall which drained itself through the inferior angle of the abdominal incision on the eighteenth day, and finally acute dilatation of the stomach occurring on the table and necessitating gastric lavage before returning the patient to her bed.

Table VII. Indications

	EXTRA-PERITONEAL	TRANS-PERITONEAL	INTRAPERITONEAL LONGITUDINAL INCISION	INTRAPERITONEAL TRANSVERSE INCISION
Cephalopelvic disproportion	2	35	69	74
Cephaloplevic disproportion and myoma		1		1
Spondylolisthetic pelvis		1		
Nägele pelvis			1	1
High breech, generally contracted pelvis		2	4	6
Transverse presentation		1		1
Dystrophia, dystocia syndrome				1
Previous classical cesarean section		4	10	14
Previous cervical cesarean section			36	58
Previous classical and cervical cesarean sections			1	
Eclampsia		3	2	
Toxemia of pregnancy			8	10
Soft part dystocia from previous vaginal plastics and suspensions			3	10
Repair of complete perineal tear and suspension			2	
Amputation of cervix and vaginal plastics			5	
Abdominal fixation of uterus causing dystocia			1	
Previous vesicovaginal fistula (repaired)				1
Congenital malformation of vagina obstructing labor		1		
Elderly primipara, rigid soft parts			1	3
Cervical dystocia		4		
Central placenta previa		2	5	6
Abruptio placentae		4		
Uterine apoplexy, toxemia of pregnancy			5	2
Valvular heart disease, mitral stenosis and regurgitation			6	4
Valvular heart disease, aortic regurgitation and mitral regurgitation			1	
Thyrocardiac				3
Previous multiple myomectomy				1
Multiple myomectomy, fifth month of pregnancy				1
Advanced pulmonary tuberculosis				1
Total	2	58	160	198

Table VIII. Anesthesia

	EXTRA-PERITONEAL	TRANS-PERITONEAL	INTRAPERITONEAL LONGITUDINAL INCISION	INTRAPERITONEAL TRANSVERSE INCISION
Local anesthesia			5	9
Spinal anesthesia		1	4	35
Ether anesthesia	2	57	151	154
Total	2	58	160	198

For local anesthesia a 1 per cent solution of novocaine is used.

For spinal anesthesia novocaine crystals dissolved in spinal fluid are employed. The dosage has been 100, 120 and 150 mg. the last dose being rarely used and only in large women.

Table IX. Postoperative Complications

EXTRAPERITONEAL   2 Cases

One patient had no complications, the temperature, pulse and respirations remained normal.

TRANSPERITONEAL   58 Cases

Septic uteri with uteroabdominal fistulas 9, or 15.5 per cent.

TABLE X

	INTRAPERITONEAL	
Longitudinal Incision. 160 Cases		
Thrombophlebitis, right leg		1
Thrombophlebitis, left leg		5
Dilatation of stomach		4
Pulmonary embolism (small embolus and recovery)		2
Sepsis of abdominal incision		3
Pyelitis		2
Lochiometra		2
Acute mastitis (no abscess)		1
Bronchitis		1
Pneumonia		1
Postpartum eclampsia		1
Transverse Incision. 198 Cases		
Thrombophlebitis, left leg		3
Pyelitis		5
Sepsis of abdominal incision		9
Pulmonary infection		3
Dilatation of stomach		2
Low grade uterine sepsis		2
Lochiometra		3
Intestinal paresis		2
Influenza		1
Eclampsia (postpartum)		1
Recurrent pelvic inflammation		1

TABLE XI. MATERNAL MORTALITY

EXTRAPERITONEAL

1 maternal death in 2 cases or 50 per cent.

CASE I.—Para i. Cephalopelvic disproportion, large child (8 pounds 14½ ounces), generally contracted pelvis, labor thirty-six hours, threatened rupture of the uterus, uterus full of meconium in a vertex presentation, fetal asphyxia, maternal exhaustion, thermic elevation, pulse varying between 120 and 130. Latzko operation performed; the peritoneum was not opened and was preserved intact during the entire operation. Transfusion 600 c.c. from her husband the same day. The patient died of general peritonitis the second day after operation.

TRANSPERITONEAL

5 maternal deaths in 58 cases or 8.6 per cent.

Causes of Death

CASE   I.—Pulmonary embolism.
CASE II.—Acute gastric dilatation.
CASE III.—Abruptio placentae and uterine apoplexy.
CASE IV.—Myocarditis, pulmonary edema, bronchopneumonia.
CASE   V.—Eclampsia, suppression of urine.

CASE I.—Para vii. Spondylolisthetic pelvis, six stillborn children following forceps extractions. Admitted after considerable labor in her home, no vaginal examinations. She died of pulmonary embolism on the fifth day after delivery. There were no abdominal complications.

CASE II.—Para i, forty-one years old, in labor sixteen hours, one vaginal examination in her home. Died of acute gastric dilatation on the fourth day. The patient who was about five feet in height weighed 250 pounds; she had a sharp promontory and no engagement after sixteen hours of labor. She had had acute dilatation of the stomach following an appendectomy a few years previously, and her history showed that she had nearly died of this complication.

CASE III.—Para i. Abruptio placentae and uterine apoplexy at term. Severe uterine hemorrhage, no dilatation, no labor. She died of the results of hemorrhage the day of operation.

CASE IV.—Para i, very obese woman weighing 275 pounds, sharp promontory, labor twenty-four hours, no engagement, right occipitoposterior, vaginal examinations in her home before admission. She died on the sixth day of myocarditis, pulmonary edema and bronchopneumonia.

CASE V.—Para i, forty years old, three weeks overdue, labor sixteen hours, 3 convulsions, all intrapartum, no engagement, 2 vaginal examinations in her home before admission. She was operated upon at 10 A.M. and died at 7 P.M. There was total suppression of urine, none having been obtained after operation.

INTRAPERITONEAL

Longitudinal Incision

9 maternal deaths in 160 cases or 5.6 per cent

Causes of Death

Bronchopneumonia, sepsis	1
Eclampsia	2
Pulmonary embolism	2
Heart disease	3
Acute gastric dilatation, intestinal paralysis	1

CASE I.—Para ii, twenty-eight years old, first pregnancy terminated by the extraction of a stillborn child presenting by the breech. During the present pregnancy she had an attack of appendicitis at seven and one-half months. She was greatly weakened by pernicious vomiting, her pulse rate was 120 from the beginning of pregnancy. Operation on August 23, 1922 after a long test of labor, the scarred cervix showing no sign of dilatation and the pulse rising to 140 with each uterine contraction. During the convalescence she developed an abscess between the lower uterine segment and the bladder; this was drained by an anterior colpotomy on September 3. Bronchopneumonia supervened and the patient died. At the time of her death she had had no abdominal symptoms and the incision had healed by first intention.

CASE II.—Para i, forty-two years old, no prenatal care, eclampsia, frequent convulsions, no labor, no dilatation. The patient was moribund when seen. Operation in the interest of the child. The mother died shortly after the intervention but the child survived.

CASE III.—Para i, thirty-six years old, at term, eclampsia, frequent convulsions, deep coma, marked cyanosis, no labor, 2 vaginal examinations, 30 c.c. of smoky urine obtained by catheter, delivered of a macerated fetus. The kidneys ceased to function after operation and she died fourteen hours after delivery.

CASE IV.—Para iii, thirty years old, two stillborn children, the first following a breech extraction, the second following version and extraction. Toxemia of pregnancy, systolic pressure 170, no labor, no vaginal examinations. Simple convalescence, incision healed by first intention. On the fourteenth postoperative day she died of pulmonary embolism while sitting in bed nursing her child.

CASE V.—Para iii. Generally contracted pelvis, two previous classical cesarean sections, no labor, no vaginal examinations. Valvular heart disease and myocarditis. She died of cardiac disease on the ninth day.

CASE VI.—Para ii, thirty years old, cephalopelvic disproportion (fetus weighed 4773 gm.), few hours of labor, no vaginal examinations. Pulmonary embolism while she was transported from the operating room to her bed, bronchopneumonia and death on the eighth day.

CASE VII.—Para i, twenty-eight years old, mitral stenosis and regurgitation with decompensation, eight months pregnant, cervical cesarean under local infiltration anesthesia, delivered of a macerated fetus. She died of acute cardiac dilatation a few hours after operation.

CASE VIII.—Para i. Central placenta previa, two hemorrhages, operated upon for pelvic peritonitis with drainage two years previously, digestive disturbances since this operation, accentuated during the pregnancy. Cervical cesarean section, transverse colon adherent to the uterine fundus, for an area 15 cm. in length, omental adhesions; the adhesions were liberated at the time of operation and the abdomen closed in the usual manner. Acute dilatation of the stomach on the table; stomach lavage, stomach lavage repeated in thirty-six hours for the same condition. Forty-eight hours after operation marked distention; jejunostomy under local anesthesia in her bed, no sign of peritonitis observed. Blood transfusion 500 c.c. The patient improved after the transfusion but gradually weakened and died a few hours later. No uterine complications.

CASE IX.—Para iii, thirty-four years old, aortic regurgitation and mitral regurgitation, two previous cervical cesarean sections, no labor, no vaginal examinations. Good recovery from the anesthesia. No distention. Died of cardiac disease on the fourth day.

<div align="center">

TRANSVERSE INCISION

6 maternal deaths in 198 cases or 3.0 per cent.

Causes of Death

</div>

Uterine apoplexy	1
Septicemia	1
Lobar pneumonia	1
Pulmonary embolism, eleventh day	1
Acute cardiac dilatation, fibroid uterus	1
Pulmonary embolism, fourteenth day	1

CASE I.—Para ii. Her first pregnancy had ended in an abortion. She had severe toxemia of pregnancy and had disregarded all the instructions given at the clinic. She was admitted at seven and a half months of pregnancy with complete separation of the placenta and uterine apoplexy. She had no labor, no vaginal examination, the membranes were intact, the cervix was long and rigid, the urine boiled solid and she was in tremendous shock on admission. A stillborn fetus was delivered. She never came out of her shock and died nine and a half hours after operation.

CASE II.—Para iii. Her first child was stillborn, her second pregnancy had ended in an abortion. She had toxemia of pregnancy, the urine boiled solid, she was getting gradually worse under active treatment, she had no convulsions. The gravid patient had had no labor, no vaginal examinations and her membranes were intact. The operation was done in twenty-two minutes and the patient left the table in excellent condition. She died of septicemia four days after operation. There were no clinical signs of peritonitis. A postmortem examination was refused.

CASE III.—Para ii, thirty-six years of age. She had been delivered by high forceps twelve years previously. She had gained seventy pounds in weight the last three months of pregnancy. She had a large child which weighed nine pounds and twelve ounces. The operation was done at term, there had been no labor, no vaginal examinations and the membranes were intact. She died of lobar pneumonia six days after operation.

CASE IV.—Para xi. Cesarean section was done because of extensive vaginal plastics and suspension of the uterus which had been performed after the previous delivery. The operation was done at term. There had been no labor, no vaginal

examinations and the membranes were intact. The patient had an afebrile convalescence, the incision had healed by first intention, and there had been no complications during the puerperium. On the eleventh day she had breakfast at 7:30 A.M. and felt perfectly well. She suddenly died at 9:13 A.M. from a pulmonary embolus.

CASE V.—Para i. The pregnancy extended twenty-three days after the expected date; there was a large calcified myoma at the right uterine horn. She had nine hours of hard labor at which time the cervix was one finger dilated. Signs of fetal distress became apparent and meconium was passed by the vagina, the fetus presenting by the vertex. There was apparent threatened rupture of the uterus. The patient had a mitral lesion. There was a weak area in the left anterior wall of the uterus. The patient went into severe shock as soon as the abdominal incision was made, the baby was quickly delivered and the uterine segment closed. The fundus acted poorly but contracted after the injection of 3 c.c. of pituitrin and 3 c.c. of ergot. The patient was in no condition to stand a hysterectomy although permission had been obtained to remove the uterus. She was given 1000 c.c. of saline solution by hypodermoclysis and was returned to bed in fair condition. She died a few hours later of cardiac dilatation. There had been no bleeding from the uterus.

CASE VI.—Para ii. The first pregnancy had terminated in an abortion at four months, one year previously. The patient showed the dystrophia, dystocia syndrome. She was of short stature, had a small pelvis and a large child. At the end of fourteen and one-half hours of labor the cervix was fully dilated, the membranes were intact and the presenting vertex was overriding the symphysis. The operation was performed under spinal anesthesia. The convalescence was uneventful except for a small stitch abscess which evacuated itself spontaneously. She got out of bed on the twelfth day, was walking on the thirteenth and was going home on the fourteen day. The morning of the fourteen day she got up and stated that she felt faint; she was put back to bed and died in a few minutes of pulmonary embolism. A necropsy was performed; a clot 2 cm. in length was found at the bifurcation of the pulmonary artery and smaller clots extending in both branches. There was a superficial stitch abscess. The abdominal cavity showed no infection; there were no adhesions; the cervical incision was healed and clean; there was no accumulation under the bladder.

MATERNAL MORTALITY

TYPE OF OPERATION		NUMBER	MATERNAL DEATH	PER CENT
Extraperitoneal (Latzko)		2	1	50.0
Transperitoneal (Veit-Fromme-Hirst)		58	5	8.6
Intraperitoneal	Longitudinal incision	160	9	5.6
	Transverse incision	198	6	3.0
Total number operations		418	Deaths 21 Per cent 5.0	

MATERNAL DEATHS

By Causes

21 deaths in 418 operations

Pulmonary embolism	5	1.19 per cent
Gastric dilatation	2	0.47 per cent
Uterine apoplexy	2	0.47 per cent
Pneumonia	3	0.71 per cent
Heart disease	4	0.95 per cent
Septicemia	1	0.23 per cent
General peritonitis	1	0.23 per cent

The highest maternal mortality 1.19 per cent was due to pulmonary embolism. For purposes of comparison I analyzed 53 classical cesarean sections which I had performed before resorting to the cervical operations. I had used the Asa B. Davis technic making the abdominal incision entirely above the umbilicus and the uterine incision in the fundus. In other words, in this type of operation the uterine incision is placed as far away from the cervix as it is possible to place it. I had 2 maternal deaths from pulmonary embolism in the 53 cases, a mortality of 3.7 per cent, three times higher than that following the cervical operation in these series of cases. My own experience has taught me that pulmonary embolism is a frequent complication of cesarean section no matter what type is employed and must be taken into account when making the decision of operation in any case.

TABLE XII. FETAL MORTALITY

EXTRAPERITONEAL

2 children were delivered; both survived.

TRANSPERITONEAL

59 children were delivered and 7 did not survive, a fetal mortality of 11.8 per cent. The causes of death were the following:

Stillborn	2
Macerated fetus	1
Prematurity	1
Premature twins, atalectasis pulmonum	2
Atalectasis pulmonum	1

INTRAPERITONEAL

Longitudinal Incision

163 children were delivered, there being 3 sets of twins and 9 did not survive, a fetal mortality of 5.5 per cent. The causes of death were the following:

Stillborn	5
Macerated fetus	2
Congenital heart disease	2

Transverse Incision

199 children were delivered and 9 did not survive, a fetal mortality of 4.5 per cent. The causes of death were the following:

Stillborn	4
Prematurity, 7½ months, mother had central placenta previa	1
Prematurity, 7 months, mother had hydramnios, fifth cesarean	1
Term, mother had acute hydramnios, sixth cesarean	1
Status lymphaticus	1
Hemorrhage of newborn, atalectasis pulmonum	1

423 children were delivered and 25 did not survive a gross fetal mortality of 5.9 per cent.

All of the figures quoted in this study are gross figures. None of the statistics were corrected.

There were 105 repeated operations, deducting 17 transperitoneal operations in which we always find a band of adhesions, we have 88 cases for study. Of these 88 cases, 25 had adhesions as described above and 63 had no adhesions whatsoever. The very important point in this study is the fact that in 105 repeated operations no intestinal adhesions of any kind were encountered.

TABLE XIII. REPEATED CERVICAL CESAREAN SECTIONS

For the purpose of this study the operations done with a longitudinal incision are grouped together as are those which were performed with a transverse incision in the lower segment. The first three groups, extraperitoneal, transperitoneal and intraperitoneal with a longitudinal incision, all having had longitudinal cervical incisions, total 220. The second group consists of 198 operations with a transverse cervical incision.

Cervical cesarean sections		418
With a longitudinal cervical incision	220	
With a transverse cervical incision	198	

REPEATED OPERATIONS

LONGITUDINAL INCISION				TRANSVERSE INCISION
6 cervical cesareans on	1 woman	6		36 cervical cesarean sections were per-
5 cervical cesareans on	2 women	10		formed on 18 women. In other words,
4 cervical cesareans on	4 women	16		18 women had two cervical operations
3 cervical cesareans on	10 women	30		with the transverse incision.
2 cervical cesareans on	42 women	84		
Total		146		

TABLE XIV. CERVICAL SCARS

LONGITUDINAL INCISION	TRANSVERSE INCISION
146 operations were performed on 59 women, therefore, 87 previous scars were examined during repeated operations.	36 operations performed on 18 women, therefore, 18 previous scars examined during the repeated operations.
84 scars were solid and invisible to the naked eye.	17 scars were solid and invisible to the naked eye.
3 scars (3.4 per cent) were defective.	1 scar was very thin. This woman had
2 of them were thin.	had 3 cervical cesarean sections with
1 of them which had been extended into the uterine body for the extraction of a voluminous fetus, was solid in its cervical part, but thinned out for an area 2.5 × 2.5 cm. in its corporeal portion.	the longitudinal incision. The fourth was performed with a transverse cervical incision. The fifth was also performed with a transverse cervical incision. It was noted at the fifth operation that the lower segment as a whole was very thin.

There were no ruptured scars in this series of cases.

TABLE XV. PELVIC DELIVERIES FOLLOWING CERVICAL CESAREAN SECTION

LONGITUDINAL INCISION	TRANSVERSE INCISION
8 parturient women were delivered through the pelvis as follows:	3 parturient women were delivered through the pelvis as follows:
3 parturients were delivered by medium forceps.	1 parturient was delivered by the Scanzoni maneuver for R.O.P.
1 parturient was delivered by the Scanzoni maneuver for R.O.P.	1 parturient had an internal podalic version and breech extraction.
1 parturient had 3 normal deliveries.	1 parturient had a normal delivery.
1 parturient had 2 normal deliveries.	
2 parturients had 1 normal delivery.	

The puerperium was normal in these 11 women who had 14 pelvic deliveries. Thirteen of the babies who had been delivered at term survived. One baby, a premature of six months, lived a few hours after a normal delivery.

TABLE XVI. POSTOPERATIVE ADHESIONS

EXTRAPERITONEAL

The woman who had an extraperitoneal cesarean section and recovered was subsequently delivered by a Porro cesarean section because she was again admitted after a long labor and frankly infected. The bladder was adherent on the left side of the uterus but was separated without undue difficulty in performing the hysterectomy.

TRANSPERITONEAL

This operation was not repeated but 17 women had intraperitoneal cervical cesarean sections performed subsequently, either with a longitudinal or a transverse incision of the lower segment. In these 17 cases a band of peritoneum varying in width was found extending from the cervix to the parietal peritoneum. This band was resected before separating the bladder for the second time.

INTRAPERITONEAL

Longitudinal Incision

Adhesions were encountered in 22 patients, one band of peritoneum from the bladder to the abdominal incision in 8 cases, 2 bands in 4 cases and 3 bands in one case. A small omental adhesion to the parietal peritoneum in 5 cases. A small omental adhesion to the uterine fundus in 2 cases; in one of these cases it was the fourth and in the other the third operation. The bladder was adherent to the parietal peritoneum in 2 cases.

Transverse Incision

Adhesions were found in 3 patients. In one woman who had had a classical and a transverse cervical cesarean one band of peritoneal adhesions was found to the classical scar, none to the cervical. In another patient who had her sixth operation, 1 transperitoneal, 3 intraperitoneal with longitudinal incision and 1 intraperitoneal with transverse incision. A small omental adhesion was found at the upper angle of the abdominal incision when performing the sixth operation. In still another patient there was a band of peritoneum extending from the bladder to the parietal peritoneum at the second intraperitoneal operation with transverse cervical incision.

SUMMARY AND CONCLUSIONS

This study is based on 418 cervical cesarean sections, extraperitoneal 2; transperitoneal 58; intraperitoneal with a longitudinal cervical incision 160; intraperitoneal with a transverse cervical incision 198.

These operations were performed by the author in 31 hospitals varying in equipment from that of the large metropolitan hospital to that of the small country hospital.

The cervical cesarean section seems to fulfill the three main considerations claimed for it by its advocates, namely, protection against septic peritonitis, better healing of the incision and an easier convalescence.

The uncorrected maternal mortality was 5.0 per cent. The best maternal mortality statistics were obtained in 198 consecutive transverse cervical cesarean sections where it was 3.0 per cent.

Pulmonary embolism gave the highest maternal mortality rate, 1.19 per cent. For purposes of comparison, 53 consecutive classical cesarean sections, with a high fundal incision, performed by the author were analyzed; the maternal mortality from pulmonary embolism was 3.7 per cent, three times higher than in the reported series of cervical cesarean sections.

From this study it is apparent that pulmonary embolism is a frequent complication of cesarean section no matter what type is employed. This fact should be taken into consideration when deciding to perform an abdominal delivery.

The gross fetal mortality was 5.9 per cent as explained in Table XII.

The cervical cesarean section may be repeated with ease. The highest number performed on one woman was 6 (Table XIII).

There were 14 pelvic deliveries in 11 women following the cervical cesarean section. The puerperium, in all of them, was normal.

In 105 repeated operations no intestinal adhesions were found.

In performing the intraperitoneal operation I prefer the transverse cervical incision to the longitudinal.

An efficient test of labor may be safely given in border line cases, thus allowing a number of women to deliver themselves through the pelvis who otherwise might have been delivered abdominally.

270 COMMONWEALTH AVENUE.

Tholen, G. A.: The Treatment of Postoperative and Puerperal Thrombosis and Embolism. Wien. klin. Wchnschr. 42: 1107, 1929.

Treatment of postoperative and puerperal thrombosis by means of the leech depends upon the action of the hirudin, elaborated in the head of the leech, which when injected into the patient through its bite, causes a marked increase in the coagulation time of the blood and thus prevents thrombosis.

The author reports 49 cases, the majority of them postpartum, which he treated by this method with very favorable results. His method consists in early application of 2 or 3 leeches to the area involved for a period of thirty to sixty minutes. Subsequent hemorrhage is controlled by pressure. If symptoms of thrombosis persist after two days the procedure is repeated. In his first series of 17 cases of puerperal thrombosis, 13 reacted well, 2 showed no effects, and 2 developed phlegmasia alba dolens. These latter 2 were first treated long after the first onset of symptoms. One case, apparently improving under treatment, subsequently developed a pulmonary embolus resulting in death.

A thrombus already formed is little affected by hirudin, and it is for this reason that the author stresses the introduction of the treatment as soon as possible after the appearance of symptoms.

FRANK SPIELMAN.

ATELECTASIS, ASPHYXIA AND RESUSCITATION IN THE NEWBORN*

Anatomic, Physiologic, and Experimental Data

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ACTIVE and rhythmic respiration in the well-developed newborn is not established unless the respiratory apparatus and the respiratory center present anatomic and physiologic integrity. Normal conditions of the respiratory apparatus, namely patency of the larynx and bronchi, are necessary for insuring adequate gas exchanges in the alveoli between alveolar air and alveolar blood. Thus, and only thus, the partial pressures of O_2 and CO_2 and the acid-base equilibrium in the circulating blood can be maintained under conditions which are indispensable for the normal functioning of the respiratory center. Conversely, anatomic or physiologic impairment of the respiratory center will embarrass or prevent the establishment of spontaneous and rhythmic respiration and if this condition is not promptly relieved anoxemia and death of its nervous cells will follow. Besides the "chemical factors, there are "nervous" stimulants playing an important part in the establishment and maintenance of the rythmic respiratory movements, which conversely, contribute to maintain, with an extreme accuracy, "constant the conditions of life in the internal environment" (the blood) as Claude Bernard has put it.

The above considerations show clearly the intimate and close interrelation of the respiratory apparatus and the respiratory center, and the impossibility of separating them in the study of asphyxia of the newborn. In this paper I am especially concerned with the anatomic and physiologic disturbances of the respiratory apparatus, namely, atelectasis and allied conditions of the lung and with ensuing changes in respiratory gas exchanges which affect the "humoral control of respiration." I shall be compelled, however, to deal with the "nervous control of respiration" in order to explain and justify my views on resuscitation.

RESPIRATORY APPARATUS

1. In the fetus and the newborn before the first breath is drawn, the lung is airless; the alveoli are collapsed, the parenchyma is fleshy in consistence, dark in color, does not crepitate and sinks in water. This is the condition, designated by the terms of fetal lung or atelectasis

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or apneumatosis, which is often reproduced in the adult when bronchial obstruction causes alveolar air to be absorbed by the blood of the alveolar capillaries. (Coryllos and Birnbaum.[1, 2]) These lungs fill the thorax completely, so that there is no negative intrapleural pressure, and on opening the thoracic wall collapse of the lung and pneumothorax will not be produced as in grown-up persons. Thus the lung is represented at that period of life by a compact and solid viscus, like the liver, which completely fills the thorax. With the first respiration the thoracic cavity expands and the diaphragm contracts so that a disproportion between the thoracic capacity and the initial volume of the lung is created. It is only later, however, that a real discrepancy in size will be established due to the rapid growth of the ribs and the vertebral column. The lung is thus distended and its elastic recoil leads to the formation of a more marked intrapleural "negative" pressure.

Circulation in the atelectatic lung is limited to the bronchial vessels. Little or no blood circulates in the intrapulmonary system of the pulmonary artery, but it is short circuited from right to the left heart through the foramen ovale and to the aorta through the truncus arterio-venosus.

The first respiratory movements, immediately after birth produce important changes in the lungs both anatomic and physiologic. The lung will dilate little by little and expand. This increase in size however is not accomplished as in a balloon; the lung "opens" like a lady's fan according to the expression of Arthur Keith.[3] The capacity of the lungs during the first hours does not exceed 30 to 50 c.c. (Henderson,[4] Wasson,[5] Von Reuss,[6] Dorn and Recklinghausen[7]) and often it takes several days before expansion is complete. It is accomplished more during forced expiratory movements with closed or narrowed glottis, as when the baby cries, than during quiet respiration. Furthermore in the "opening" of the alveoli a resistance has to be overcome represented by the cohesion and capillary tension of the alveolar walls which are in contact in the fetal lung. In our experimental investigations, Dr. Birnbaum and myself,[8] have found that a positive pressure equal to 14 cm. of water is necessary to inflate the atelectatic lung in the dog. This point, to my knowledge, never mentioned before, is of paramount importance in resuscitation. It shows clearly that inflation of the lungs in the newborn is a rather slow procedure; it explains why for several days or even weeks, large atelectatic areas can persist in the lung (Wasson,[5] Von Reuss[6]) and above all the ease with which bronchial obstruction can oppose the relief of atelectasis. The expansion of the alveoli has as an immediate result the opening-up of the perialveolar capillaries, tributaries of the pulmonary artery. This opening develops at the same time with inflation of the alveoli and in fact, depends upon it. This is another proof of

the interdependence of ventilation and circulation in the lung; it reinforces the theory which we defended in a previous paper[9] on the circulation in the atelectatic and consolidated lung (in atelectasis, lobar pneumonia and bronchopneumonia), that, conversely, when the alveoli collapse the circulation in the alveolar capillaries is practically suspended. In the newborn the immediate result of the opening of the alveolar capillaries is that the blood of the pulmonary artery flows toward the lungs, where resistance (14 mm. Hg) is considerably smaller than in the left heart and the aorta (140 mm. Hg). The foramen ovale gradually closes as the blood no longer impinges against the eustachian valve as it did during intrauterine life. In this way all the blood is directed toward the lung and the pulmonary circulation is established.

From the above considerations it becomes obvious that persistence of atelectasis in the newborn will be followed by the most severe respiratory and circulatory disturbances. If atelectasis is very extensive, and not promptly relieved, death will rapidly follow because of asphyxia, the mechanism of which I shall study more closely later. If it is only partial and represented by atelectatic areas, lobar or lobular, and distributed throughout the otherwise well aerated lungs it may be the origin of infectious complications such as pneumonia or bronchopneumonia which cause a tremendous mortality in the newborn and especially in those who have presented respiratory troubles at birth. In a recent thorough statistical study, Yandell Henderson[4] arrived at the conclusion that combined stillbirth and neonatal deaths due to respiratory complications amount to nearly 8 per hundred births, that is, to over 150,000 deaths a year in this country alone. The question consequently is of importance and deserves a closer study.

RELATION OF ATELECTASIS TO PULMONARY INFECTIONS

The relation of atelectasis to bronchial obstruction cannot be questioned in the newborn as it has been and still is in the adult. Furthermore it constitutes a further proof in favor of the obstructive origin of any form of atelectasis and shows clearly the paramount importance of bronchial obstruction in acute and chronic lung infections. The succession of the different phases: bronchial obstruction, atelectasis, impaired bronchial drainage, bronchial stasis-infection, is presented in the newborn in an almost schematic way. No "previous conditions" intervene here to befog the etiologic relationship between the first and the latter; furthermore the absence of "negative" intrapleural pressure and of circulation in the lung show the futility of the theories which attribute atelectasis to paralysis of the diaphragm or to bronchomotor or vasomotor reflexes. Most important of all however is the evidence brought in favor of our[10, 11]

theory that lobar pneumonias, and bronchopneumonias, medical as well as postoperative are really infectious, massive, lobar or lobular atelectases. It is my contention that all pneumonias and broncho-pneumonias in the newborn start as lobar or lobular atelectases, due to obstruction of lobar or lobular bronchi. If the obstructing agent is artificially or spontaneously eliminated the lung will be reaerated, its free drainage insured and its means of defense restored. If, on the contrary, bronchial obstruction persists, the atelectatic and undrained area of the lung, in which bronchial exudate is accumulating, can easily be secondarily infected by microorganism coming from the nasopharynx and upper respiratory tract; thus, an aseptic atelectasis will be transformed to a septic one, and pneumonia or bronchopneu-monia will develop, according to the distribution of the atelectasis
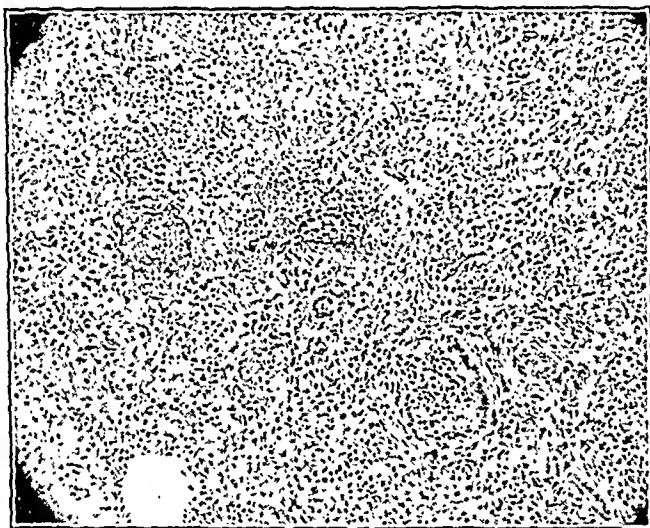
Fig. 1.—Persistent atelectasis in a newborn due to bronchial obstruction.

and the nature of the infecting agent. The fact that these conditions are developed on atelectatic areas, which were obviously aseptic at the beginning, and that the causative infecting microorganisms iden-tified in them were present also in the nasal and pharyngeal cavities of these patients establishes the succession and the pathogenesis of the lesions.

Cruickshank[12] in his special report of the Medical Research Council on the causes of neonatal death, gives the results of 800 autopsies; 179 among them were pneumonias, so that "the frequency of pneumonia was practically 23 per hundred deaths." He further adds, "many of these cases which have been placed in the group of 'deaths from infection' were doubtless predisposed to these infections by the effects of birth asphyxia. It is obvious that a deeply congested and imperfectly expanded lung is much more liable to the development of pneumonia than one in which circulation and aeration are free." Peiser (in von Reuss,[6] Diseases of the Newborn) states that "Pneumonia, which is very apt to supervene when the risk of infection exists in the atelectatic portion of the lung is a very frequent cause of

death in infants,'' and further he concludes that ''the treatment of atelectasis must be directed toward expanding the lungs by stimulating deep respirations.'' Von Reuss[6] is even more explicit: ''among resuscitated from stillbirth 20-30 per cent succumb to sequelae, especially in the first two days, while through the first week the mortality among such infants is seven times the rate of those born

Fig. 2.—Epidermic cells in the alveoli, following premature respiratory movements and aspiration of amniotic fluid.
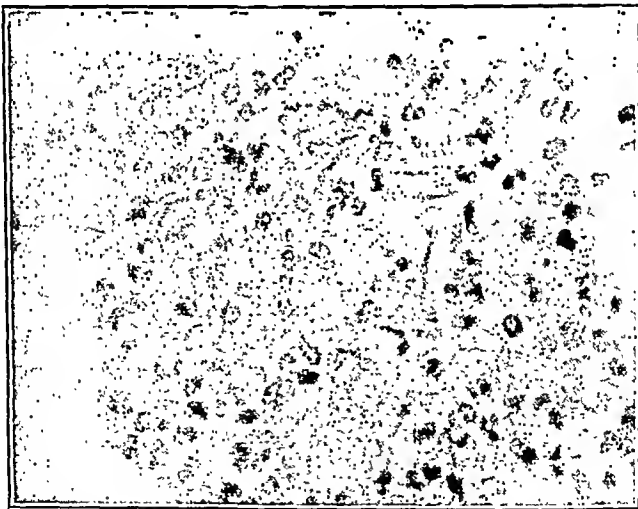
Fig. 3.—Greater enlargement of Fig. 2, showing the epidermic cells.

normally,'' he adds that in the majority of cases this is due to atelectasis and to the danger of inflammatory complications in the atelectatic portions of the lung (Y. Henderson[4]).

The obstruction is generally due to the mucous exudate. It can, however, in cases of difficult and asphyxial birth be meconium or even epidermic cells manifestly aspirated with amniotic fluid. In these cases we deal with real intrauterine submersion. Figs. 1, 2, and 3

show atelectatic areas due to bronchial obstruction with cells, which are to be found even in the alveoli.*

The above data, which establish I believe the relation between atelectasis and inflammatory complications of the lung, present striking similarities to postasphyxial pneumonias observed in cases of CO_2 poisoning (Y. Henderson, 1930) which developed on atelectatic areas of the lung and which can be prevented by having the lung well expanded, as occurs when these patients are resuscitated by the O_2-CO_2 inhalational treatments of Henderson and Haggard. Upon the same principle are based prevention of postoperative lung complications[14] and treatment of lobar pneumonia.[15]

DISTURBANCES OF "HUMORAL" AND "NERVOUS" CONTROL RESPIRATION

Asphyxic phenomena in the newborn, in absence of serious damage of the respiratory center, can be likened to respiratory troubles occurring when a resistance is offered to respiration. This resistance can be strong, producing almost complete obstruction of the respiratory ways, or only weak and partial.

Davies, Haldane and Priestly[16] showed (1919) that a strong resistance to respiration produces first slowing and deepening of the respiratory rate. This is due to the fact that, because of the resistance, complete inspiratory distention or expiratory collapse are slow to be established. It is known, that in the so-called Hering-Breuer[17] reflex, as we shall see later, pulmonary distention inhibits inspiration and starts expiration, and vice versa, expiratory collapse inhibits expiration and starts inspiration. The slowing of the respiration has as result the accumulation of CO_2 and the increase of its tension in the arterial blood, which acting upon the center, produces more vigorous respiratory movements tending to reestablishment of normal respiratory rate. But as this cannot be accomplished because of the resistance, after a period of strong and deep respiratory movements, shallow and rapid breathing will be established due to anoxemia, rapidly followed, if obstruction is not immediately relieved, by decompensation of the respiratory center, and death.

These authors and later Dautrebande[18] (1924) showed that even weak resistances act in a very similar way; at the beginning the respiration is slowed, but as CO_2 accumulates respiratory movements become deeper and stronger and thus, because of the weakness of the resistance, the normal respiratory rate is established. A new type of respiration is established, of normal rate but of increased depth and volume of tidal air. If this condition is prolonged, especially in the newborn in which the pulmonary capacity is very limited, periodic respiration will be established, often Cheyne-Stokes' type, due to fatigue of the center and will be followed by rapid shallow breathing which increases anoxemia still further and leads to decompensation of the respiratory center and death. Dautrebande and Delecourt[19] (1928) showed that in this period even oxygen administration might be without effect. Without entering into great physiologic detail I shall give a brief résumé of the intimate mechanism of the respiratory disturbances described above which are necessary for a better comprehension of the requirements for the resuscitation methods.

*These slides were prepared by Dr. M. A. Goldzieher, Pathologist to Israel Zion Hospital.

Let us consider first the pathologic physiology of the atelectatic areas. If atelectasis is complete and limited especially to one lobe, it will cause no other trouble than slight and temporary anoxemia due to the decrease of the respiratory field. In fact this portion of the lung will be shut off not only to ventilation but also to circulation, because complete collapse of the alveoli is always accompanied by complete collapse of the alveolar capillaries.[9] In that way there will be no circulation through unaerated pulmonary channels. It is not the same with disseminated and incomplete atelectatic areas in which the alveoli are partially distended, although their ventilation is very deficient. In these cases circulation will keep on, and thus a more or less considerable amount of blood will return to the left auricle insufficiently oxygenated. It is obvious that in the cases of incomplete atelectasis the arterial blood of the left heart will be polluted by the blood which has passed through insufficiently aerated channels of the lung, so that the hemoglobin will be incompletely saturated, whereas CO_2 tension will increase. In these cases hyperpnea and intense cyanosis will be present.

It is interesting to notice here that atelectasis is maintained in the newborn by the same mechanism by which it is produced in the grown-up, namely, bronchial obstruction. In the latter apneumatosis (airlessness) is produced by absorption of the alveolar gases by the blood circulating in the alveolar capillaries. This absorption is accomplished according to the laws which normally regulate gas exchanges in the lungs. (Table I.) In other words, atelectasis or apneumatosis is a normal phenomenon following an abnormal ventilation. If the alveolar respiratory membrane is healthy and the circulation normal, this phenomenon depends upon, and is regulated, by the partial pressures of the gases in the alveoli and in the blood.

Hyperpnea is due to increase of CO_2 (Miescher,[20] 1881, Haldane and Smith,[21] 1893) or more exactly to the reaction of the blood, which depends upon hydrogen-ion concentration, conventionally expressed by P_H. This is in great part a function of the fraction

$$\frac{H_2\text{-}CO_3}{NAH\text{-}CO_3}$$

in which the nominator is the pressure of CO_2 in solution in the blood, expressed as carbonic acid, and the denominator is the total volume of CO_2 in the blood expressed as sodium bicarbonate. It is obvious that the P_H will be unchanged as long as the ratio of acid to base is constant, and this independently of their individual variations.

Fig. 5 gives the dissociation curve of CO_2 in the arterial and venous blood. It shows that when the pressure of CO_2 in the blood increases the total volume of CO_2 (bicarbonate) increases correspondingly. Conversely a drop of CO_2 pressure is accompanied by drop in bicar-

bonates. In the case of increase of CO_2—we deal with acidosis, in the second—decrease of CO_2—with alkalosis, which are called gaseous, in order to be distinguished from nongaseous acidosis and alkalosis which are due to primary variations of the bicarbonates; as for instance in ingestion of bicarbonates (nongaseous alkalosis) or in the presence in the blood of nonvolatile acids which attack the bicarbonates as in diabetes (nongaseous acidosis).

TABLE I

ALVEOLAR AIR		VENOUS BLOOD		
	PER CENT	PARTIAL PRESSURE in mm. Hg.		PER CENT	PARTIAL PRESSURE in mm. Hg.
O_2	15	114	O_2	5	38
CO_2	5	38	CO_2	6	45.6
N_2	80	608	N_2	—	608

Table I.—Showing the relative partial pressures of O_2, CO_2 and N_2 in mm. of Hg.
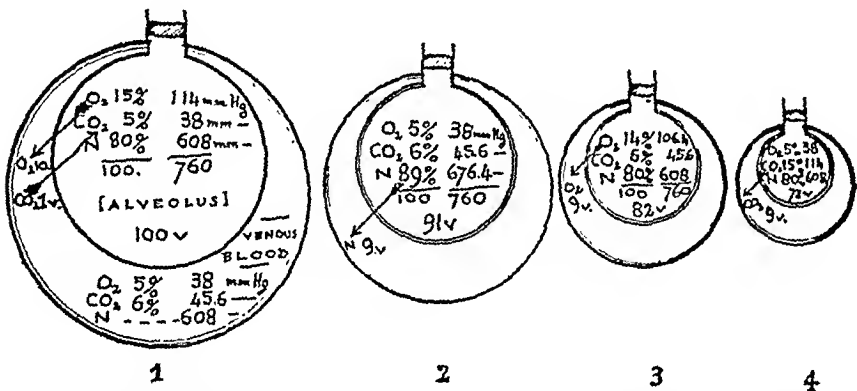
Fig. 4.—A schematic representation of alveolar gas exchanges, gradual gas absorption and shrinkage of the alveoli after complete bronchial obstruction. The absolute volume of the alveolus is only approximately indicated, but the figures given are relative and demonstrate perfectly well the principles involved. In *1*, ten volumes of oxygen diffuse into the venous blood and one volume of carbon dioxide diffuses out of the venous blood into the alveolus. In *2*, the alveolus has now lost nine volumes of gas as stated under (*1*) and the oxygen and carbon dioxide have come into equilibrium in the venous capillary blood and in the alveolus. However the percentage and partial pressure of nitrogen have now been increased so that nine volumes of nitrogen diffuse out of the alveolus into the venous blood. In *3*, nine volumes of nitrogen having previously diffused out of the alveolus into the venous blood, the percentage and partial pressure of oxygen or carbon dioxide have been relatively increased. For purposes of explanation let us say the oxygen has been alone thus relatively increased in pressure. Nine volumes of oxygen are now ready to diffuse to the venous blood. In *4*, nine volumes of oxygen having diffused from the alveolus into the blood, we can now consider that the carbon dioxide in the alveolus is relatively increased by these nine volumes. Thus the partial pressure of this gas is relatively increased and carbon dioxide is ready to diffuse out of the alveolus. Thus the cycle continues until all gases of the lung are absorbed, although actually the gas exchanges are going on simultaneously and not in the isolated way which we have ideally considered. (After Coryllos and Birnbaum.[2])

The regulation of the acid-base equilibrium is insured in a remarkably sensitive way by the blood, the respiratory center, the kidneys and the liver; however, we can say that all the tissues of the organism contribute to the accurate maintenance of this equilibrium.

The immediate results of resistance to the respiration will be a decrease in oxygen and increase in CO_2 tension; the alkali of the blood will increase (Henderson and Haggard,[23] 1918), in other words the curve of dissociation of CO_2 will rise; at the same time the respiratory center will be stimulated and hyperpnea will be induced tending to wash out excess of CO_2. But if, because of the resistance, hyperventilation is not able to produce adequate decrease in the pressure of CO_2, the ensuing acidosis may be compensated by increease of the total CO_2 in the blood (bicarbonates). The prolongation of this condition will produce in the newborn results very similar to the ones observed in dogs which have been maintained for a long while in a
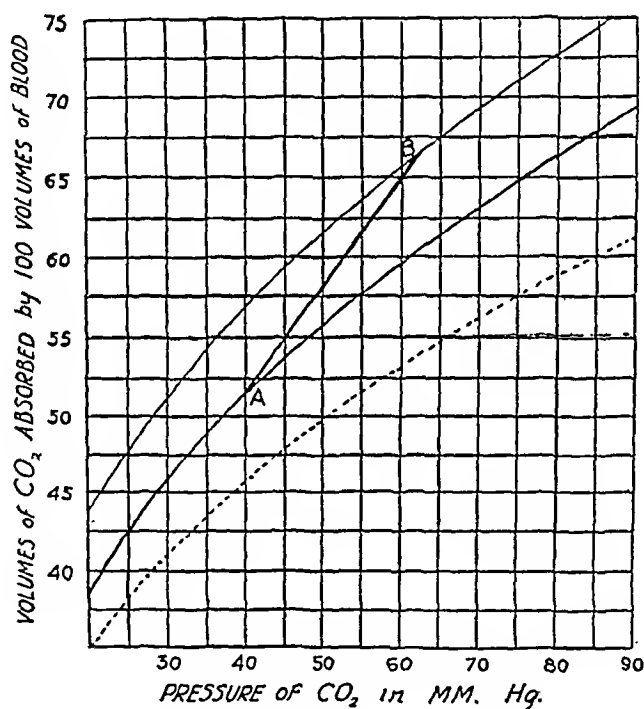
Fig. 5.—A schematic representation of my theory of production of atelectasis.
This curve shows the influence of the saturation of the hemoglobin with oxygen on the amount of CO_2 taken up by the blood at various pressures.
Upper curve: Absorption of CO_2 by human blood in presence of hydrogen and CO_2.
Middle curve: Absorption of CO_2 by human blood in the presence of air and CO_2.
Lower curve: Absorption of CO_2 in blood of ox and dog in presence of air.
The thick line A-B represents the absorption of CO_2 by human blood within the body (supposing the blood is completely deoxygenated in the tissues).
It is evident that an increase of 15 c.c. per cent of CO_2 in the blood, passing through the tissues, would raise the tension of this gas in the blood only 22 mm. Hg (from 40 to 62). Under normal conditions the rise of CO_2 pressure in the blood on passing through the tissues is not more than 5 or 7 mm. Hg. (Starling.)

chamber with increased CO_2 tension (6 to 10 per cent) in the atmospheric air (Henderson and Haggard[23]). These animals get adjusted to the high percentage of CO_2 because their alkali increases correspondingly; if they are placed again in pure atmospheric air in which CO_2 tension is only 0.03 per cent, they present a very prolonged apnea which may kill them by anoxemia. I would suggest the following

explanation for this phenomenon. The elimination of the CO_2 being much more rapid than the adjustment of the bicarbonates, the animals present a real alkalosis to which the respiratory center responds by apnea. It seems to me that this explanation is, in the case of newborn asphyxia, more suitable than the one given by Henderson and Haggard, namely, that the respiratory center becomes adjusted to higher levels of CO_2 and requires greater concentrations of it to be stimulated, for two reasons. First because in the cases of asphyxiating newborn there is always anoxemia present which lowers the threshold of existability of the respiratory center to CO_2, which means that the center becomes more sensitive to CO_2. Second because the real
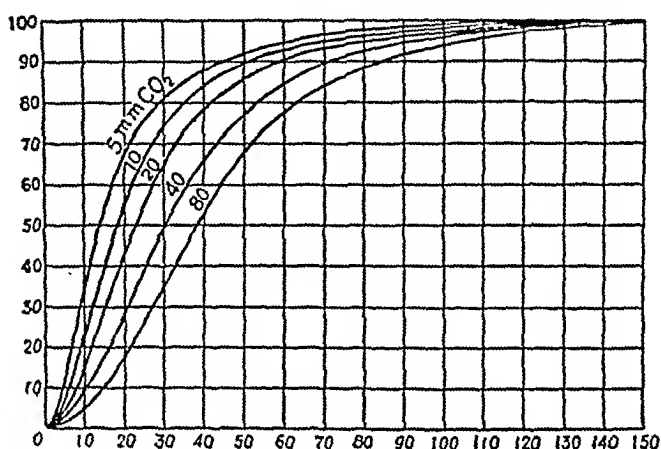
Fig. 6.—Curves representing the percentage of hemoglobin with oxygen at different partial pressures of O_2 and CO_2. Dog's blood at $38°C$. Ordinates indicate percentage saturation with O^2. Abscissa shows partial pressure of O_2 millimeter of mercury. (Rohr, Hasselbach and Krogh.)

respiratory hormone is the P_H of the blood, so that the important factor is not the absolute value of CO_2 but the value of the ratio $\frac{H_2CO_3}{NAH\ CO_3}$. This fact has to my mind a paramount importance in the choice of methods of resuscitation as we will see later.

A second phenomenon which may occur following hyperventilation with ordinary atmospheric air is the "Bohr phenomenon." In spontaneous hyperpnea or artificial ventilation, when unaerated channels still persist in the lung because of bronchial obstruction, increase in anoxemia and decompensation of the respiratory center may occur, although cyanosis decreases or disappears. Bohr[24] has shown that hyperventilation will wash out CO_2 more efficiently than it will increase the O_2 saturation of hemoglobin. The first because CO_2 is 32 times more diffusible than O_2 so that it will diffuse into the alveolar air and wash out very rapidly. It is not the same for the O_2. In Fig. 6, which represents the curve of dissociation of oxyhemoglobin in various pressures of CO_2, an easy explanation of this fact is given. When O_2 is present in the alveolar air under a pressure of 90 mm.,

corresponding to 12 per cent in volume, hemoglobin is almost completely transformed to oxyhemoglobin 90 per cent. Consequently even a considerable increase of O_2 per cent tension in the alveolar air will have almost no effect upon the saturation of hemoglobin; so it cannot greatly modify the average O_2 saturation of hemoglobin of the mixed blood, which is polluted by the nonarterialized blood passing through unaerated pulmonary channels. But on the other hand this hyperventilation will have a disastrous effect, because of the lowering of the pressure of CO_2. As it is apparent in the above curve, with a pressure of O_2 of 35 mm. Hg. (4.6 per cent), and a normal pressure of CO_2 (5 per cent, equal to 40 mm. hg.) only 50 per cent of hemoglobin will be transformed in oxyhemoglobin so that strong cyanosis will be present. But if the amount of O_2 remaining the same, CO_2 is washed out so that its pressure falls to 5 mm. Hg. (0.51 per cent) hemoglobin will be 82 per cent saturated so that cyanosis will disappear. But oxyhemoglobin under these conditions holds fast to the O_2, so that it does not give it up easily to the tissues, and in this way, although cyanosis decreases, giving the false impression of a better oxygenation, anoxemia really increases and the life of the patient is threatened more than ever. I really believe that the ''Bohr effect,'' which I have never seen mentioned in relation to resuscitation in asphyxia, is of an overwhelming importance in it, not only because it explains a number of failures heretofore puzzling and inexplicable, but also because it clearly shows the importance of CO_2 in resuscitation and respiration.

A third phenomenon is ''acapnia'' described by Henderson in 1909. This author showed that hyperventilation with ordinary air, in washing out CO_2 produces apnea which naturally causes anoxemia; when CO_2 is allowed to accumulate again, as anoxemia has rendered the respiratory center more sensitive to CO_2, hyperpnea will be established at a lower level of CO_2 concentration, so that the CO_2 will be washed out more rapidly and before hyperpnea has had the time to compensate anoxemia. In this way a vicious circle can be established, especially in cases in which the respiratory center is already damaged so that rapid shallow breathing will follow hyperpnea and periodic respiration.

A last point which is necessary to study in order to have in hand all the elements of the ''nervous control'' of the respiration which are indispensable in the study of resuscitation, is the part played by the vagi in the so-called Hering-Breuer reflex. ''Though through stimulation of other sensory nerves of the body,'' says Starling,[25] ''the respiratory movements can be altered reflexly, it is only through the vagi that a continuous stream of impulses pass to the center under normal circumstances so that every respiratory movement is modified by these impulses.''

The vagi contain two kind of afferent fibers or at any rate afferent fibers with two functions. Stimulation of the first kind stops inspiration and produces expiration; stimulation of the other stops expiration and produces inspiration. The first are stimulated when the lungs are collapsed. This is known as the "Hering-Breuer reflex." It can be shown by simply closing the trachea at the end of inspiration or of expiration. But the action of this reflex is much more marked when by a tube introduced in the trachea the lungs are rhythmically inflated and collapsed. The inflation produces an instantaneous and complete relaxation of the diaphragm; collapse of the lung, on the contrary, produces a tonic contraction of the diaphragm. Lumsden[26] admits the existence of two sets of afferent fibers in the vagi which are respectively stimulated by the passage of the air through the trachea and the bronchi. So that blowing downward through the upper part of the trachea causes expiration, while a current of air upward causes inspiration. The Hering-Breuer[18] reflex is completely suppressed when the vagi are suctioned (Starling[25]).

RESUSCITATION

From the above consideration it follows that the anatomic and physiologic requirements for a rational procedure of resuscitation are: Remove or lessen any resistance to the respiration, relieve anoxemia as quickly as possible, assure a good expansion of the lungs and prevent washing out of CO_2.

We shall lay aside the old methods of "swinging, spanking and chilling" the newborn. They are empiric and unscientific methods, which can render some services in extreme emergency but generally do more harm than good. Manual artificial respiration should be also completely discarded as inefficient because of the anatomical conditions already dealt with and as dangerous because of the ease with which ribs can be fractured and the liver damaged.

Inflation of the lungs of the newborn baby by mouth to mouth insufflation is a more rational method, the best of all empiric methods, provided that obstructing agents are previously removed. It helps the inflation of the lungs with air containing a fair amount of CO_2 (3 to 5 per cent). It presents, however, the great danger of rupture of the alveoli, a complication generally fatal.

The remaining methods are three:

1. Inhalation of a mixture of 6 to 10 per cent of O_2-CO_2 with an ordinary anesthesia mask, as proposed by Henderson and Haggard.

2. Intratracheal suction and insufflation with the same mixture as proposed by Flagg.[27]

3. Mechanical prolonged, passive artificial respiration, devoid of the dangers of manual artificial respiration, by using differential negative pressure as used in the respirator of Drinker and Shaw.[28]

The first two have the great advantage over the third in that they use CO_2. The presence of this gas constitutes an absolute physiologic necessity which has been shown, stressed and popularized by Y. Henderson and Haggard who rendered a real service in so doing. More particularly each of these two procedures has its special indications. In cases of slight asphyxia the method of Henderson and Haggard is recommended by its simplicity in instrumentation and modus operandi. In cases of advanced asphyxia, I personally prefer the method of Flagg. The question of instrumentation has been simplified by the construction by this author of a handy laryngoscope, a special short and small diameter intratracheal tube and a water manometer-safety valve. As far as the technic is concerned, I earnestly believe that every physician can and should be familiarized with it. In the cases of advanced asphyxia, in which this method is especially indicated, the absence of laryngeal reflex renders the procedure easy and harmless. On the other hand it presents in advanced cases, the following advantages upon any other method: first, it clears the larynx and the trachea of any possible obstruction by initial suction through the tracheal tube, and also, it clears the big bronchi themselves, by the return current created by the insufflated air. Second, it is a rapid method, because it brings directly to the lung the necessary amount of CO^2-O_2, and it insures the perfect and complete inflation of the organ. Third, and this is a marked advantage, it overcomes the cohesion of the collapsed alveolar walls and puts to work the powerful Hering-Breuer reflex. I had the opportunity to use this method in studying resuscitation of drowned human beings and experimental animals and in cases of ether syncope. I have been strongly impressed by its great efficiency and its rapid action.

The method of Drinker and Murphy is an excellent procedure when a prolonged artificial respiration is necessary as in toxic inhibition of the respiratory center by alcohol, morphine or other narcotics, or in cases of paralysis of the respiratory muscles as in acute poliomyelitis. I do think that it does not present the same advantages in resuscitation of the newborn, because it neglects the two fundamentals necessary for successful resuscitation: the anatomic one, which is the patency of the respiratory ways, and, more especially, the physiologic one which is the absolute necessity of the presence of CO_2 in high concentrations in the respiratory air given to the newborn. It must not be forgotten, however, that in cases of cerebral hemorrhage this method associated with O_2-CO_2 inhalations can render important services.

SUMMARY AND CONCLUSIONS

1. Asphyxia in the newborn is a complicated phenomenon, due to anatomic deficiency of the lungs, defective gas exchanges and physiologic imbalance of the respiratory center.

2. The anatomic factor, namely, persistent fetal or partial atelectasis of the lung, is always due to bronchial obstructions. It threatens by immediate or delayed asphyxia, because of anoxemia due to defective gas exchanges, and predisposes to infectious complications, such as pneumonia or bronchopneumonia, to which are due the most important number of neonatal deaths.

3. The importance of the curves of dissociation of oxyhemoglobin and of CO_2, and especially their interrelation in the study of asphyxia of the newborn has been shown.

4. The "Bohr effect" and the "Hering-Breuer" reflex have been studied and their significance in resuscitation has been insisted upon.

5. The different procedures for resuscitation, more especially of Henderson and Haggard, of Flagg and of Drinker have been presented and discussed.

REFERENCES

(1) Coryllos, P. N., and Birnbaum, G. L.: Arch. Surg. 16: 501, 559, 1928. (2) Idem: Arch. Surg. 21: 1214-1281, 1930. (3) Keith, A.: Further Advances in Physiology. Edited by Prof. Leonard Hill, London, 1909. (4) Henderson, Y.: J. A. M. A. 96: 49, 1931. (5, 6, & 7 here quoted from this paper). (5) Vasson, W. W.: J. A. M. A. 83: 1240, 1924. (6) Von Reuss, A. R.: The Disease of the Newborn, N. Y., 1929, William Wood & Co. (7) Dorn and Recklinghausen: Quoted in Henderson.[4] (8) Coryllos, P. N., and Birnbaum, G. L.: A New Method for the Study of Gas Exchanges in the Lung. (9) Idem: Arch. Surg. 19: 1346-1423, 1929. (10) Idem: Bull. of the N. Y. Academy Med. Sec. Series 4, 384, 399, 1928; Arch. Surg. 18: 190-241, 1929. (11) Idem: Am. J. M. Sc. 178: 15, 1929; A. M. A. J. Roentgenol. 22: 401-430, 1929; Am. J. M. Sc. 178: 8, 1929. Coryllos, P. N.: Surg. Gynec. Obst. 50: 795-827, 1930; J. A. M. A. 93: 98, 1929. (12) Cruickshank, J. N.: Child Life Investigations; the Causes of Neonatal Death. Research Council, Spec. Report Series No. 145, H. M. Stationary Office, Adastral House, Kingsway, London, W. C. 2, British Library of Information, 5 East 45th St., N. Y. City. (13) Henderson, Y.: J. A. M. A. 94: 179, 1930. (14) Scott, W. T. M., and Cutler, E. C.: J. A. M. A. 90: 1759-1763, 1928. Scott, W. T. M.: J. A. M. A. 93: 101, 1929. (15) Henderson, Y., Haggard, H. W., Coryllos, P. N., and Birnbaum, G. L.: Arch. Int. Med. 45: 72, 1930. (16) Davies, H. W., Haldane, T. S., and Priestley: J. Physiol. 53: 60-69, 1919. Also Haldane, T. S.: Respiration, New Haven, 1927, p. 59. (17) Hering, E., and Breuer, T.: Die Selbsteucrung der Athmung durch den Nervus Vagus. Sitzungsh. Wien. Akad. 57: 2, 1868. (18) Dautrebande, L.: Les Echanges Respiratoires. Les Presses Universitaires de France, Paris, 1930. (19) Dautrebande, L., and Delcourt: Ann. de physiol. 4: 594, 1928. (20) Miescher: Arch. Anat. u. Physiol, 335, 1885. (21) Haldane, T. A., and Smith, L.: J. Path. & Bact. 1: 168, 318, 1893. (22) Haggard, H. W.: J. Biol. Chem., 1919. (23) Henderson, Y., and Haggard, H. W.: J. Biol. Chem. 33: 333, 1918. (24) Bohr, C., Hasselbach, and Krogh, A.: Centralbl. f. Physiol. 16: 22, 1903. (25) Starling, E. H.: Principles of Human Physiology, ed. 4, Philadelphia, 1926, Lea & Febiger, p. 932. (26) Lumsden: J. Physiol. 57: 153, 354, 1923; 58: 81, 1923. (27) Flagg, P. F.: J. A. M. A. 91: 788, 1928; Arch. Otolaryng. 12: 23, 1930. (28) Drinker, P., and Shaw, L. A.: J. Clin. Invest. 7: 229, 1929. Drinker, P., and McKhann, C. F.: J. A. M. A. 92: 1658, 1929.

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THE MECHANISM OF LABOR FROM THE NEUROLOGIST'S POINT OF VIEW*

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THE neurologist regards labor with a great deal of awe and regards obstetricians as extremely bold persons who are performing very delicate physiologic experiments with powerful instruments wielded by powerful forces. The neurologist thinks of the fetus as a rather delicate nervous system surrounded by pliable and rather fragile envelopes of bones, muscles, and skin. He visualizes the process of labor as a series of pressure changes involving almost directly the tissues of the central nervous system, and he is inclined to believe that the obstetrician has not carried his conception of the mechanism of labor inside the craniovertebral cavity.

Naturally, nobody has any distinct evidence as to the pressure changes within the craniovertebral canal during labor, but it is possible to reason out a mechanism which seems to fit the known facts. If this attitude is treated with any respect, it follows that the obstetrician is responsible for watching a whole series of phenomena, not from the point of view of progress up or down a canal but from the point of view of shifting pressures within a closed cavity.

During the process of descent through the pelvis the fetal head is subjected to tremendous compression. It seems reasonable to suppose that very little blood enters or leaves the supratentorial cavity. It is, however, obvious that the medulla must be nourished and provided with oxygen. The arrangement of the dural septa is such as to protect the medulla from the severe conditions of pressure exerted on the supratentorial cavities. The compression of the baby in an ordinary head presentation prevents any descent of the medulla by providing an equal pressure from below. This normal mechanism persists until delivery of the head when an almost perfectly devised decompression occurs as the head is delivered. Breech extraction, even if unassisted, removes certain safeguards in the way of equalized pressure, and the breakdown of the mechanism is evidenced by the frequency with which tentorial tears are found.

Another peril that faces the child is the result of persistent delay. Obviously, edema and a resultant anoxemia may occur from this cause also. When interference is deemed advisable, it is obviously possible to work out a method of reenforcing physiologic forces of which forceps delivery is an example, or it is possible to impose an entirely new force, that of traction, as is done in breech extraction.

The neurologist, looking at obstetrics from a purely theoretical point of view, is impressed with the fact that most obstetric teachers do not seem to emphasize the fact that traction is completely unphysiologic. The mere fact that it is unphysiologic is, of course, of no importance, since practically all surgery is unphysiologic, in its nature. The only quarrel the neurologist has with the obstetrician is that he doubts whether he fully appreciates the nature of the material on which this unphysiologic force is imposed.

If this whole conception of labor is valid, it seems obvious that the obstetrician ought to watch labor as an experiment in control of intracranial and intraspinal mechanism as well as an experiment in forces acting upon an inert mass of tissue.

When the baby is once born, it is, of course, in the highest degree important to decide whether apnea, which may become alarming, is caused by disturbance of intracranial pressure, or whether it is the result of frank chemical causes. Obviously, if the child's intracranial and spinal contents are damaged, the most certain way of causing trouble is to produce further intracranial pressure. The traditional methods of performing artificial respiration should be reviewed with greatest rigidity. In the first place, if the baby has not taken a breath, compression of the trunk can only drive blood into the head. It cannot possibly favor the entrance of air into a collapsed lung. If, therefore, the medulla is inactive through trauma or through long-continued pressure, it seems in the highest degree illogical to handicap this region of the brain further by pumping in more blood. The whole question as to whether or not air actually gets into the lungs with various methods of artificial respiration is, of course, of cardinal importance. Quite clearly, no method that does not get air into the lungs will be effective no matter what the composition of the air is. From the purely experimental neurophysiologic point of view, the Drinker Respirator seems ideal. One of the things that has astonished and rather depressed certain neurologists is the degree of success by which physiologists maintain life in decerebrate animals in laboratories, and the rather prompt death of certain apneic infants.

Nobody is foolish enough to suppose that competent obstetrics can be performed by neurophysiologists. On the other hand, the carrying out of the principles of control of intracranial pressure, and the proper physiologic methods of resuscitation may be of the greatest assistance to the members of an harassed profession who are dealing, of course, with urgent cases.

THE DRINKER RESPIRATOR TREATMENT OF THE IMMEDIATE ASPHYXIA OF THE NEWBORN*

WITH A REPORT OF 35 CASES

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RECENTLY Murphy and Coyne described the first use of a Drinker respirator in the treatment of 5 newborn infants suffering from a severe grade of asphyxia. Each infant finally developed normal rhythmic breathing during the treatment, and 2 of the 5 were discharged from the hospital alive, fourteen days after birth. From these observations, and from unpublished experimental data, the Drinker respirator was believed by them to offer the simplest, safest and most scientific method for treating asphyxia of the newborn. The present contribution deals with the same treatment of an additional group of 35 asphyxiated newborn infants.†

To quote from the previous article,[1] the principle upon which the Drinker respirator works is briefly as follows:

"The patient is placed in a metal box or respirator with his head protruding from one end through a snugly fitting rubber collar. When the respirator is closed, the body is in a relatively air-tight container, with the head exposed to room air. By means of an electrically driven pump and valve arrangement, changes of air pressure are induced within the respirator. Thus, moderate degrees of accurately measured negative pressure are made to alternate rhythmically with atmospheric pressure. When negative pressure is applied, air at atmospheric pressure enters the respirator through the nose, mouth, and trachea; it is drawn into the lungs and the chest expands. When the negative pressure within the respirator returns to normal, the elastic recoil of the chest produces expiration."

A photograph of an infant size Drinker respirator is shown in Fig. 1, with a doll in the negative pressure chamber.

Absence of breathing in the newborn, as regards the time of its occurrence, can be studied conveniently under 2 headings, (1) when observed for the first time at birth, and (2) the acute respiratory failure which may not appear until some hours or even days after birth. The latter is usually seen in immature infants; the former is to be observed in mature infants as well as in immature ones. The present report concerns the treatment of immediate birth asphyxia.

Records of 35 infants, treated by the Drinker method, form the basis for this report. They constitute 4.9 per cent of 709 consecutive live births, observed in 2 teaching maternity hospitals. Summaries of their records appear in Table I. The material is arranged in 2 parts; the first deals with infants which were alive at the last observation, i.e., when their mothers were discharged from the hospital. The second section includes the infants who died in the hospital while under observation. It will be noted that all of the infants were handicapped by reason of either the prenatal condition of the mother, the nature of the delivery or by immaturity. Hence they suffered from more than a simple lack of oxygen or excess of carbon dioxide, or both.

The only preparation for the mechanically induced artificial respiration, consisted of clearing the upper air passages of any obstructing
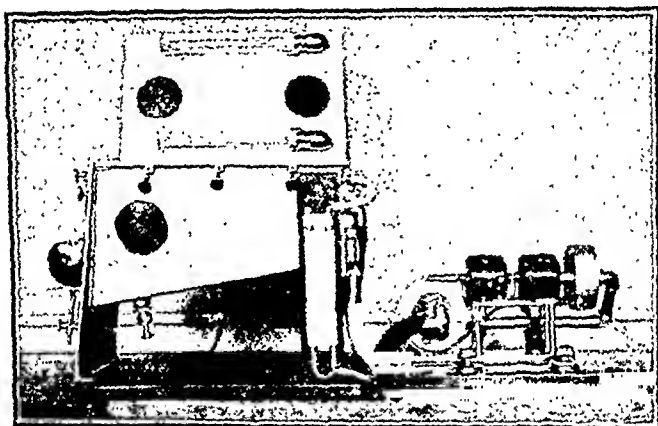
Fig. 1.—Photograph of infant size Drinker respirator with doll in the negative pressure chamber. The depth and rate of breathing are controlled by the motors shown on right, each controlled in turn by a rheostat. The depth and frequency of the pressure changes are recorded on the manometer seen in the center of the picture.

material. This was effected by holding the infant head down while aspirating the nasopharynx with a soft rubber catheter. During the artificial respiration period the aspiration was repeated as needed. As soon as the upper air passages were believed to be clear, the infant was placed in the respirator and treatment was begun. The latter was carried on with the infant tilted head down, at an angle of 15° to 20°, as shown in Fig. 1. The baby was either in the supine or prone position. Using the supine position, it was easier to observe the mechanically induced respiratory movements, and the cardiac impulse.

Table I shows summary of records of 35 asphyxiated newborn infants, treated in Drinker respirator. The first 21 infants were discharged from hospital alive, the last 14 died in the hospital. The latter are arranged according to the cause of death, as indicated by autopsy or by clinical findings.

TABLE I.　RECORDS OF INFANTS TREATED IN DRINKER RESPIRATOR

SERIAL NUMBER	HOSPITAL NUMBER	PRENATAL DIFFICULTIES	DELIVERY	BIRTH WEIGHT POUNDS	BIRTH WEIGHT OUNCES	BREATHING ATTEMPTS BEFORE TREATMENT	TREATMENT STARTED; MINUTES AFTER BIRTH	FIRST SPONTANEOUS BREATH; MINUTES OF TREATMENT	FREQUENT RHYTHMIC BREATHING; MIN. OF TREATMENT	DURATION OF TREATMENT (MIN.)	DURATION OF OBSERVATION DAYS	HR.	MIN.	CONDITION AT LAST OBSERVATION	CAUSE OF DEATH	METHOD OF DIAGNOSIS
1	7596	U None	Cesarean section	5	5	3	8	9	9	9	29			Alive		
2	7646	U Eclampsia	Cesarean section	3	6	3	9	12	28	28	23			Alive		
3	2476	L Preeclampsia	Cesarean section	4	4	Few	2	1	9	9	17			Alive		
4	2784	L None	Cesarean section	4	11	0	1	9	8	8	48			Alive		
5	7758	U Preeclampsia	Breech	5	11	0	2	6	9	9	28			Alive		
6	7756	U None	Breech	5	6	0	1	2½	5	6	12			Alive		
7	358M	L Placenta previa	Version	6	2	0	1	3	23	23	29			Alive		
8	7569	U None	A-T forceps	7	3	0	1	9	15	15	13			Alive		
9	7764	U None	High forceps	7	14	0	2	3½	4½	6	12			Alive		
10	7769	U None	Midforceps	5	3	2	2	4	5	8	13			Alive		
11	7793	U None	Midforceps	6	8	1	6	5	28	32	21			Alive		
12	2550	L None	Midforceps	6	9	Few	9	1	4	5	12			Alive		
13	2890	L Preeclampsia	Midforceps	9	10	?	1	4	7	7	16			Alive		
14	7772	U None	Low forceps	6	3	9	5	4	9	11	13			Alive		
15	7857	U None	Low forceps	6	13	2	1	5	14	14	13			Alive		
16	361	L None	Low forceps	7	13	0	2	1	8	8	11			Alive		
17	2616	L None	Low forceps	6	5	0	1	1	5	16	13			Alive		
18	392	L Eclampsia	Low forceps	5	11	3	10	9	6	13	15			Alive		

TABLE I—Cont'd

SERIAL NUMBER	HOSPITAL NUMBER	PRENATAL DIFFICULTIES	DELIVERY	BIRTH WEIGHT		BREATHING ATTEMPTS BEFORE TREATMENT	TREATMENT STARTED; MINUTES AFTER BIRTH	FIRST SPONTANEOUS BREATH; MINUTES OF TREATMENT	FREQUENT RHYTHMIC BREATHING; MIN. OF TREATMENT	DURATION OF TREATMENT (MIN.)	DURATION OF OBSERVATION			CONDITION AT LAST OBSERVATION	CAUSE OF DEATH	METHOD OF DIAGNOSIS
				POUNDS	OUNCES						DAYS	HR.	MIN.			
19	2788 L	None	Low forceps	7	1	Few	11	½	17	20	11			Alive		
20	2790 L	None	Low forceps	6	10	Few	8	1½	10	10	14			Alive		
21	2368 L	None	Spontaneous	6	11	Few	5	2	10	10	12			Alive		
22	7579 U	None	A-T forceps	6	8	1	1	Few	0	120		2		Dead	Cerebral hemorrhage	Autopsy
23	7713 U	None	Low forceps	4	11	0	1.4	4	6	15		2	15	Dead	Cerebral hemorrhage	Autopsy
24	2303 L	None	Version and A-C head forceps	9	2	0	4	0	0	28				Dead	Cerebral hemorrhage	Autopsy
25	2919 L	None	Version	6	12	0	8	0	0	123		2	03	Dead	Cerebral hemorrhage	Autopsy
26	+422 M	None	Midforceps	8	1	0	3	0	0	10			10	Dead	Cerebral hemorrhage	Clinical
27	2458 L	Preeclampsia	High forceps	8	5	Few	26	1	0	36			36	Dead	Cerebral hemorrhage	Clinical
28	7562 U	None	Spontaneous	2	6	1	15	6	9	65		1	05	Dead	Prematurity	Autopsy
29	3359 L	None	Version	3	8	Few	3	?	3	30		1	07	Dead	Prematurity	Autopsy
30	2349 L	None	Version	2	12	2	5	2	21	21		4	20	Dead	Prematurity	Autopsy
31	2657 L	Eclampsia	Cesarean section	2	9	Few	2	1	4	4	18	00	00	Dead	Prematurity	Autopsy
32	2550 L	None	Version	4	8	0	15	½	2	2	11	4	30	Dead	Prematurity	Clinical
33	2429 L	Eclampsia	Low forceps	4	10	Few	7	?	20	20		11	15	Dead	Prematurity	Clinical
34	2575 L	None	Spontaneous	?	?	0	?	?	0	71		1	37	Dead	Prematurity	Clinical
35	2898 L	None	Spontaneous	1	12	3	6	3½	33	443		8	54	Dead	Prematurity	Clinical

Abbreviations:
U = University Hospital.
L = Lying-In Hospital.
A-T = Axis-Traction Forceps.
A-C = After coming head forceps (Piper).
0 = Negative Findings.
? = Knowledge Inaccurate.

The prone position, however, with the head down and turned to the side gives opportunity for better drainage of the air passages. The respirator motors were adjusted to give a breathing rate of 45 per minute for one group of infants, and 35 per minute in another group. The negative pressure employed was sufficient to raise the column of water in the manometer (shown in the center of Fig. 1) from 8 to 10 cm. With these settings it was possible to secure an adequate degree of ventilation, as indicated by the number of infants who survived. Less than 8 cm. pressure has been found to be inadequate in maintaining artificial respiration in a certain percentage of cats paralyzed with curare. Though pressures above 10 cm. may be used in the treatment of cats or infants, if the upper air passages are clear of any obstructing plugs of mucus, etc., it is inadvisable to exceed this level very much in the treatment of infants at birth, since the condition of the air passages, at that time, cannot be ascertained.

In each case treatment was carried on until the infant developed a normally rapid rhythmic respiratory activity, or until no evidence of life existed. The latter was indicated by the changed color, and by auscultation of the cardiac area, after opening the respirator.

Only 3 of the 35 infants failed to breathe at all during their treatment. A few gave one or two gasps, but never developed a normally rapid rhythmic type of breathing. The breathing of the surviving infants developed in the following manner: A single spontaneous breath would appear during the course of treatment. This would consist of a short but weak gasp, associated with a spasm involving the head and neck muscles. It would be followed by similar breathing efforts, exhibiting an increasing frequency and vigor, until a point would be reached when the rate was rapid and steady. The respirator would then be stopped, since the infant would be breathing adequately for its needs. It had been observed in experimental studies upon animals, and in the treatment of other infants,[1] that the respirator was of little, if any, value, when spontaneous breathing was fully established. When this had begun, the animal or infant totally ignored the influence of the machine, holding its breath at will, or breathing at an independent rate, as the case might be.

Essential data pertaining to the treated infants is recorded in Table I. It will be noted that the majority of the infants survived, in spite of the poor prenatal conditions of the mothers and the difficulties of the deliveries. It will be further observed that the surviving infants were those which were the more mature, as indicated by their birth weights.

Information upon the time interval between birth and the beginning of artificial respiration, and its relation to survival of the infant, is summarized in Table II. It will be noted here that the majority of the infants received their first treatment more than two minutes after

birth. While on the other hand those which received their treatment earlier, showed the largest number of survivors.

TABLE II. INTERVAL BETWEEN BIRTH AND TREATMENT

TIME IN MINUTES	NUMBER OF INFANTS	CONDITION AT LAST OBSERVATION	
		ALIVE	DEAD
Within 2	15	12	3
2- 5	6	2	4
5-10	8	5	3
10-	5	1	4
	—	—	—
Totals	34	20	14

Table II shows a summary of data taken from Table I, dealing with the interval between birth and the start of Drinker respirator treatment of 34 infants. Note the decrease in the number of surviving infants, with the increase of the interval between birth and the beginning of treatment.

A glance at Table III indicates to a certain extent at least, the degree of asphyxia exhibited by the patients, as shown by their respiratory power during the period before treatment was instituted. Twenty-five of the 35 had taken three, or less than three breaths before being treated.

TABLE III. BREATHING ATTEMPTS BEFORE TREATMENT

BREATHS	NO. OF INFANTS
None	14
3 or less	11
Few (number not recorded)	10
	—
Total	35

Summary of data taken from Table I, dealing with the respiratory power of the 35 treated infants, before Drinker respirator treatment was instituted. Note that 26 of the 35 infants breathed less than 4 times prior to the start of their treatment.

The time of the first spontaneous breath after the start of treatment was noted in 24 instances (Table IV). It will be observed that the majority of infants exhibited the first sign of spontaneous respiratory activity within the first four minutes of treatment, that one infant, which took no spontaneous breath for the first twelve minutes, finally breathed normally and survived.

Onset of rapid rhythmic breathing was studied in 32 infants. Of these, 6 never breathed with normal rapidity. The interval between the start of treatment and the time of the rhythmic breathing of the remaining 26 is given in Table V. It will be seen from this table that 3 infants survived, though their normal breathing did not return until after twenty minutes of artificial respiration.

The infants were followed to the date of their discharge from the

TABLE IV. TIME OF FIRST SPONTANEOUS BREATH DURING TREATMENT

TIME IN MINUTES	NUMBER OF INFANTS	CONDITION AT LAST OBSERVATION	
		ALIVE	DEAD
Within 2	11	7	4
2-4	8	6	2
4-6	4	3	1
12	1	1	0
Totals	24	17	7

Summary of data taken from Table I, dealing with time of onset of first spontaneous breath to take place during treatment. Note that one infant survived, though it did not breathe spontaneously until twelve minutes of respirator treatment had been given.

TABLE V. ONSET OF RHYTHMIC (RAPID) BREATHING

TIME IN MINUTES	NUMBER OF INFANTS	CONDITION AT LAST OBSERVATION	
		ALIVE	DEAD
Within 5	8	5	3
5-10	9	8	1
10-20	4	3	1
20-30	4	3	1
30-35	1	0	1
Total	26	19	7

Summary of data from Table I, dealing with the time of onset of rapid-rhythmic (normal) breathing of 25 infants treated in the Drinker respirator. Note that three infants survived, though they did not develop an adequate spontaneous respiratory activity until more than twenty minutes of respirator treatment had been given.

hospital. Of those which died, it will be noted in Table I, a number of them lived for several hours after birth, and two lived eleven and eighteen days respectively. It is evident from this, that the infants who survived for some time were suffering from injury other than simple asphyxia. When the respirator was effective in permitting spontaneous breathing to begin, and for this to be followed by a rapid rhythmic form of breathing, its function as an aid in the treatment of the asphyxia was then ended.

Of the infants who survived (21) it is quite impossible to say to what extent they were saved by the use of this method of treatment. It is firmly believed that certain of them at least, owed their lives to the treatment, and that no doubt others were saved from degrees of asphyxia which, though they would not have caused death, might have produced serious damage to vital tissues.

Of the infants who did not survive, death was believed to have resulted from two chief causes, (1) injury to the cranial contents, and as a result of (2) prematurity. (Table VI.) Of the 14 dead infants, 8 came to autopsy, which helped to confirm the diagnoses.

TABLE VI. DEATHS

CAUSE	NUMBER OF INFANTS	EVIDENCE	
		AUTOPSY	CLINICAL
A. Cerebral hemorrhage	6	4	2
(Average weight,			
7 pounds 3 ounces)			
B. Prematurity	8	4	4
(Weights)			
1. 4 pounds 10 ounces			
2. 4 pounds 8 ounces			
3. 3 pounds 8 ounces			
4. 2 pounds 12 ounces			
5. 2 pounds 9 ounces			
6. 2 pounds 6 ounces			
7. 1 pound 12 ounces			
8. (No record)			

Summary of data taken from Table I, regarding the cause of death of 14 asphyxiated infants treated in the Drinker respirator. Note the decided immaturity of the infants diagnosed as having died as a result of immaturity (prematurity) contrasted with the average weight of those infants who died of cerebral hemorrhage.

COMMENT

It is evident that in maternity hospitals at least, asphyxia neonatorum is a major obstetric problem, in view of the high percentage of infants that exhibit this condition (approximately 5 per cent). It is also apparent that many asphyxiated infants, when properly cared for ultimately survive. The cause of the asphyxia, at the time of birth, cannot always be determined. Regardless of this, or of the degree of asphyxia, artificial respiration should be instituted, and be maintained as long as any evidence of life exists. It is presupposed, however, that the upper air passages have been cleared of all obstructive material before any form of artificial respiration is employed.

In the recent report by Murphy and Coyne,[1] one infant failed to exhibit a spontaneous breath until artificial respiration had been maintained continuously for one hour and four minutes. From this, and from other observations, it is believed that no commonly employed method of artificial respiration (including the Drinker method) actually incites the respiratory apparatus into activity in infants suffering from deep asphyxia, though it may act as a stimulant. The chief indication therefore is to maintain an adequate degree of pulmonary ventilation over a long period of time. It is possible that during this period the respiratory center may of its own accord begin to function, and to a degree sufficient for the needs of the organism.

If this theory is tenable, the Drinker respirator offers the best method of treating asphyxiated newborn infants, since by its use it is possible to maintain an adequate pulmonary ventilation for an indefinite period of time. Its advantages are the following: The principle of its action is sound. The negative pressure acts upon each square inch of the chest equally, without the application of undue

pressure at any single point. The machine has already reached a high degree of perfection, and the limits of safety of its use have been studied upon experimental animals. The machine can be so adjusted that the normal rate and depth of breathing of the newborn infant can be closely approximated, to insure adequate ventilation without at the same time producing symptoms of overventilation.

Treatment is available at an instant's notice, and may be carried on for an indefinite period, without effort on the part of the attendant, and with the minimum expenditure of energy on the part of the infant. If the latter is immature, and later respiratory failure is likely to occur, the infant can live in the machine so that treatment can be started at a second's notice. The negative pressure chamber is so built that the body can be maintained horizontally or head down. The latter position is the best during treatment, since it aids the gravity discharge of fluids from the upper air passages.

The infant can be maintained in surroundings of any temperature desired, above that of room temperature. At the same time its head is exposed to the cooler room temperature, which has a higher and therefore more desirable moisture content. Throughout the treatment the infant lies perfectly quiet, except for the movements of the chest wall induced by the machine, and is not subjected to any force that cannot be both controlled and measured. Nor is he subjected to the dangers of pulmonary infection, always a possible sequel of mouth-to-mouth insufflation.

In conclusion it may be said that the use of the Drinker respirator, in its clinical application to the treatment of asphyxia neonatorum, has passed the purely experimental stage of its development; that when employed, using the amount of negative pressure (8 to 10 cm.) and breathing rate (45 per minute) as herein advised, there need be no fear that any possible damage can result to the infant so treated. The apparatus is so simple of construction and of operation, that its operation can be readily understood by the average person, which fact gives it a very wide field of usefulness.

REFERENCE

(1) *Murphy, D. P., and Coyne, J. A.:*   J. A. M. A. 95: 335, 1930.

THE TREATMENT OF POSTNATAL ASPHYXIA*

By Paluel J. Flagg, M.D., New York, N. Y.

ASPHYXIA is a generic term implying oxygen want.
The specific instances of asphyxia exhibited in foreign body obstruction, asphyxia neonatorum, drug poisoning, submersion, electric shock, and anesthetic accidents, all show a common sequence of signs and symptoms.

Asphyxiated patients, whether baby or adult, are readily grouped into three classes as follows:

In the first class, we find the depressed patient, the patient who may be roused, whose respiratory center, circulation, muscle tone, and reflexes while subnormal from anoxemia are readily stimulated and quickly resume their normal functions. These cases are by far the most numerous.

Second, we find the patient who cannot be roused, whose respiration is markedly affected, giving rise to varying degrees of cyanosis, whose circulation shows the effect of decreased ventilation, by reason of decreased rate and volume, whose muscle tone is reduced, and whose superficial reflexes are in abeyance.

And then we find the third class, the case of extreme asphyxia, the patient whose respiration has ceased altogether, whose circulation is failing, whose muscle tone and reflexes have entirely disappeared. It is upon this class that we, as physicians, should focus our best energies, for this is the patient who dies unless he be promptly and effectively stimulated with oxygen and carbon dioxide.

Of the specific instances of asphyxia which demand our attention, asphyxia neonatorum offers the most fertile field for the following reasons:

Preparation may be made in advance.

We meet our patient at once, without the delay, for example which usually occurs in submersion, gas poisoning, etc.

The vitality of the baby is much greater than the adult.

Owing to his size and easily approachable respiratory structures, he offers less resistance to treatment.

Finally, the very delicacy of the structure involved encourages and rewards painstaking and precise treatment.

The physiologic pathology involved in asphyxia, while intricate in its relations, follows, nevertheless, a definite sequence of mechanical events which render logical treatment comparatively simple. Pre-

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natal atelectasis plus asphyxia from any cause, such as anesthesia, cord pressure, central pressure, drugs, foreign body obstruction, etc., results in a high right heart pressure, low left heart pressure, open foramen ovale, reduced cerebral circulation, continued anoxemia, increased central pressure, and if unrelieved, a dead baby.

The indications are, therefore, to relieve at once prenatal atelectasis, and to prevent postnatal atelectasis arising from bronchial obstruction. The alveolar capillaries may then be readily oxygenated, decreasing the right heart pressure, increasing the left heart pressure which closes the foramen ovale, throws an increased circulation in the respiratory center, and in addition to oxygenating it, affords stimulation by the CO_2 which has been added to its normal gas content.

In the midst of these considerations, one is apt to pause and reflect, "I have done obstetrics for years, and I do not seem to run into these asphyxial difficulties." However, it is a generally accepted fact that out of every 100 babies born, 4 die regrettable deaths, and of these 4, at least 1 dies from the acute asphyxia under consideration.* Therefore, in every service of 100 cases a month, dating from this evening, ten to twelve babies are to die before next December 9. It is upon this group of doomed babies that we now fix our attention.

In view of what has been said, how may we best make use of available facilities to decrease the fetal mortality from asphyxia during the coming year?

First of all it is as important to grasp the actual degree of asphyxia present as it is to make a diagnosis and prognosis in a surgical abdomen, typhoid, or pneumonia. The immediate question to be asked and answered is, Into what class of asphyxia does this baby fall? Is he merely depressed, is he dying, or is he quite obviously a borderline case?

1. The depressed case, the baby who breathes occasionally in gasps, who moves about when stimulated, who empties his bladder, who resists movements of his head and his extremities, usually responds to any form of stimulation. He responds successfully to resuscitation

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*The Bureau of Vital Statistics of the New York Board of Health furnished the following figures for the year 1929 in stillbirths:

Total population for the five boroughs	6,881,882
Total number of births recorded	124,404
Total number of stillborn	5,726

Of this total of 5,726,

535	due to cord pressure
164	due to breech
111	due to malposition
184	due to deformed pelvis
354	ascribed to difficult labor
265	due to asphyxia,
	giving a total of 2,013.

For the sake of a conservative estimate, we might reduce this figure by 30 per cent, giving us a total of approximately 1,200 deaths for approximately 120,000 births, or 1 per cent.

This 1 per cent fetal mortality at birth does not include the neonatal deaths directly due to atelectasis, antenatal and postnatal, and to postnatal pneumonia, and pulmonary complications due to aspiration.

by the spanking, tubbing technic. He will promptly and vigorously respond to inhalations of oxygen CO_2 offered to him by a pharyngeal tube or a small mask applied over his face. Such babies, so stimulated, promptly reach a stage of crying and struggling which overcomes their atelectasis through automatic, intratracheal pressure against the closed glottis. Every case of depression, however, should receive the benefit of pharyngeal suction, for all efforts to increase the depth of the respiration by pharyngeal tube or inhaler, in the presence of fluid in the pharynx is a direct means of inducing aspiration and postoperative pneumonia, as well as postoperative atelectasis and bronchiectasis.
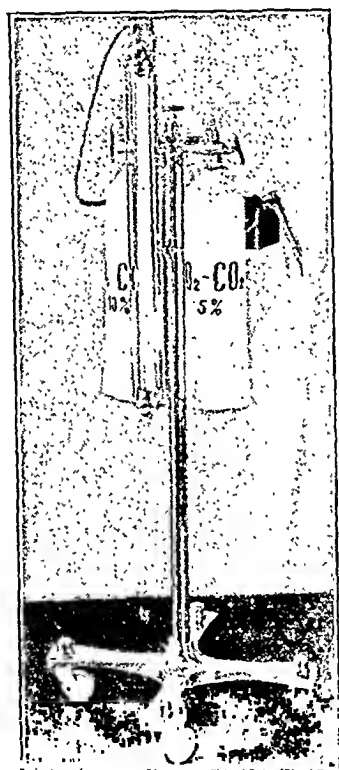
Fig. 1.—Resuscitation apparatus (Flagg), hospital model.

2. The asphyxiated baby whose respiration occurs at long intervals and only following external stimulation, whose muscles are relaxed, who offers no resistance to the opening of the mouth, should be immediately laryngoscoped, and the pharynx aspirated.

If there is no reflex irritation induced by this aspiration, the glottis should be intubated with the suction tube under direct vision and the trachea aspirated.

The reflex tone of the glottis is the best indication of the child's viability. If the reflex is active, he will promptly respond to oxygen CO_2. If there is no reflex spasm of the glottis, the baby falls into the third class of asphyxia. He is dying.

3. Such a baby demands immediate and full oxygenation and the stimulating effects of CO_2. As we observe such an infant and see the lividity or the pallor of the skin, the total absence of respiration, the flicker of a heart impulse through the chest wall, the complete loss of muscle tone, it is easy to understand the necessity for prompt, vigorous action. The upper portion of the respiratory tract from the lips to the vocal cords has become a collapsed flabby tube containing more or less fluid. Ordinary physics demands that this tube be opened, that fluid be removed, and that a patent gas channel which will reach past
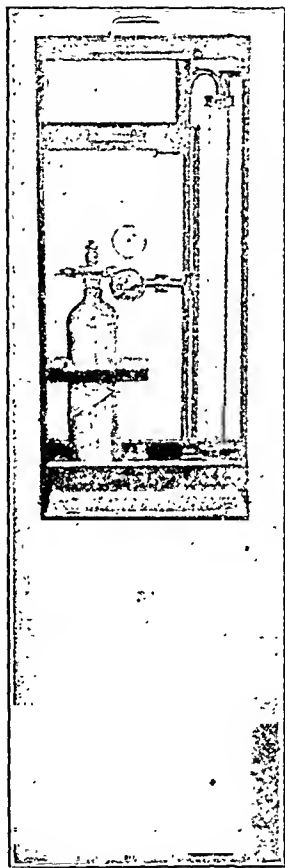
Fig. 2.—Resuscitation apparatus, portable model.

obstruction into the trachea be promptly introduced. Through such a tube, oxygen CO_2 may be delivered under measured pressure. Such pressure overcomes atelectasis, allows of an immediate diffusion and absorption of oxygen CO_2 which relieves the right heart pressure, increases the left heart circulation, and throws the necessary stimulation into the depressed respiratory center.

The treatment of postnatal asphyxia may be summed up as follows: The actual condition of the baby is the guide to the treatment which he requires. The actual condition of the baby is measured by his muscle tone and reflexes.

Every baby, without exception, is entitled to an immediate post-operative toilet which includes suction of the mouth and pharynx. This treatment alone will play a definite part in preventing postoperative pulmonary complications due to aspiration.

If muscle tone and reflexes permit of easy laryngoscopy, this should be done at once and the pharynx and the larynx inspected.

Should the baby offer no resistance to this procedure, the larynx should be intubated and aspirated.

If the glottic reflex is reduced or abolished by the anoxemia present, the insufflation tube should be introduced and intratracheal insufflation of oxygen CO_2 under pressure of 15 to 20 mm. of mercury, seven-and-a-half to ten inches of water should be promptly carried out. This treatment should be continued until respiration is reestablished, or, in the absence of a reestablished respiration, until the heart has ceased to beat and cyanosis develops in the face of this intratracheal oxygen insufflation, indicating the final failure of the circulation.

In conclusion, I believe that the treatment of postnatal asphyxia implies first of all, recognition of the degree of asphyxia, aspiration, laryngoscopy, intratracheal suction, intratracheal insufflation of oxygen CO_2, under measured pressure with the continuation of insufflation, until respiration is reestablished, or until the circulation is proved to have failed, as evidenced by the persistence of cyanosis in the presence of a high percentage of oxygen in the alveolar air.

The technic described is designed to meet every type of asphyxia with the utmost directness and simplicity.

In view of the practical success of this technic in the wide field of asphyxias, one may with safety predict that before long every hospital organization will find it necessary to add to its existing department, the department of gas therapy, whose field shall include the scientific resuscitation of infant and adult, oxygen therapy, as now widely employed, and finally the supervision and the administration of inhalation anesthetics.

189 EAST SIXTY-FOURTH STREET.

THE INHALATIONAL METHOD OF RESUSCITATION FROM ASPHYXIA OF THE NEWBORN*

By Yandell Henderson, Ph.D., New Haven, Conn.

(From Yale University)

THE object of the inhalational method is much broader than mere resuscitation from asphyxia at birth. It aims to insure that the child shall not only be alive at birth, or alive the next day, but also alive at the end of the neonatal period of three or four weeks. More deaths now occur in the neonatal period than the total of stillbirths. More lives can be saved from the secondary effects of incomplete dilatation of the lungs in the neonatal period than from primary birth asphyxia.

The inhalational treatment of asphyxia has therefore two aspects: (a) It is the sole and only really effective method of resuscitation from primary asphyxia at birth that nature and science afford. It can save many lives now lost at birth. (b) In addition it can achieve a far larger saving of life from among those who now die in the neonatal period.

The large majority of the babies that breathe spontaneously nevertheless retain for hours or days or even for weeks undilated areas in their lungs. From this condition of unrelieved atelectasis result secondary asphyxia and neonatal pneumonia. Cruickshank's observations in Scotland, as well as those of Wasson in this country and von Reuss in Germany, demonstrate that pneumonia consequent upon atelectasis causes two-thirds of all the deaths in the neonatal period, nearly as many in fact as the total of stillbirths.

For the nonbreathing newborn child I favor the simplest apparatus: A small cylinder of a mixture of oxygen and 7 per cent carbon dioxide, a mask to enclose the face, and a rubber bag of only 2 or 3 liters capacity with a valve or stopcock at the end. The bag is filled and the cylinder shut off. The mask is held on the face while the bag is squeezed to make a gentle pressure sufficient to cause a succession of slight dilatations of the child's lungs. Then as spontaneous breathing begins the inhalation is continued. Or, if desired, mouth to mouth dilatation may be used and then the inhalation administered.

It is the inhalation and its stimulating effects upon natural breathing rather than any form of artificial respiration that is most important.

This inhalation should be given several times a day for five or ten minutes for several days. It should be administered, not only to the asphyxiated, but to all normal children as well. The object is to insure full dilatation of the lungs. When this inhalation is universally adopted, instead of the ancient practice of making the child cry, the vast number of children that now die of pneumonia consequent upon continuing atelectasis during the neonatal period will be saved, in addition to those that can be resuscitated most effectively in this way from primary birth asphyxia.

The essential point regarding birth asphyxia is that, as a result of diminished blood supply to the brain during prolonged labor, the sensitivity of the respiratory center is depressed. In the normal child the respiratory center is stimulated, as soon as the placental circulation slows down, by the carbon dioxide formed in the child's own body. In the asphyxiated child, although there may be more carbon dioxide than normally, the center is so depressed that this stimulus is insufficient to excite natural breathing. But when a sufficient percentage of carbon dioxide is administered to the lungs, the center responds quite normally.

REFERENCES

(1) *Cruickshank, J. N.:* Medical Research Council Special Report, Series No. 145, H. M. Stationery Office, London. (2) *Henderson, Y.:* J. A. M. A. 96: 495, 1931. (3) *Von Reuss, A. R.:* The Diseases of the New-Born, New York, William Wood & Co., 1929, pp. 304 ff. (Full literature.) (4) *Wasson, W. W.:* J. A. M. A. 83: 1240, 1924.

Langhorst, Henry F.: Prevention of Puerperal Infections. Ill. M. J. 54: 298, 1928.

Dietetic regulation, sufficient and graduated exercise, exposure of body to sunlight and sufficient bathing are important to prevent lowered resistance to puerperal infection. Foci of infection should be eradicated. The author cites 4 patients with focal infection who developed puerperal infection, one of whom died.

HIEMSTRA.

HEMANGIO-ENDOTHELIOMA INTRAVASCULARE OF THE OVARY*

A Review of the Literature With a Report of a Case

By Francis W. Sovak, M.D., F.A.C.S., and Victor Carabba, M.D., New York, N. Y.

(From the Gynecological Department of the University and Bellevue Medical College, and Pathological Department of Bellevue Hospital)

HEMANGIO-ENDOTHELIOMA intravasculare of the ovary is a very rare neoplastic disease. An extensive review reveals only four cases reported in all the literature. The case herein described represents the fifth and only case in American medical annals.

There have been reported 52 cases of ovarian endothelioma in general, all of them by continental observers. One case classified as angiosarcoma ovarii, published by Cullen in the Johns Hopkins Hospital Reports, is of questionable nature, probably of perithelial origin. The foreign cases reported were classified according to Borst's classification; namely, hemangio-endothelioma, intravascular and perivascular, and lymphangio-endothelioma. Thirty-two of the cases were lymphangio-endotheliomas arising from the lymphatic system and lymphatic spaces; 4 were cases of hemangio-endothelioma intravasculare, 2 arising from the blood capillaries and 2 from the blood vessels; 14 were cases of hemangio-endothelioma of the perivascular type, 12 of which arose from the endothelium of perivascular lymph spaces and 2 from the adventitial cells; 2 cases were metastatic from endothelioma elsewhere.

In spite of the seemingly common occurrence of this tumor variety in general, opinions of pathologists differed as to whether the endotheliomas should be considered as belonging to the group of sarcomas or to that of the carcinomas (epithelial growths). Kubo, after studying the work of Virchow, Volleman, and C. Hertwig (mesenchymal theory), came to the conclusion that there is no doubt that the fully differentiated endothelium is much more closely related to connective tissue than to epithelium, especially so as there often occurs normally transition from endothelial cells to true connective tissue cells, whereas no such occurrence is observed even in pathologic growths of epithelium.

REVIEW OF LITERATURE

In 1864, v. Recklinghausen reported a tumor extirpated from the orbit as having arisen from the endothelial lining of the lymphatics. Since then, 52 cases have been reported in the literature of tumors arising from the lymphatic and

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*Read before the New York Obstetrical Society, November 11, 1930.

peri- and intra-vascular systems of the ovary. Leopold,[2] in 1874, was the first to prove extensive growth of endothelial elements in ovarian tumors and described a very large growth which he derived from the endothelium of lymph vessels.

In 1879, Marchand[3] published an interesting paper in which he stated for the first time and with absolute certainty that his patient had a tumor growth of endothelial nature in the ovary. He concluded, first, that it was a cystic papillary tumor of the ovary derived from the endothelium of lymphatics; second, a cystic tubular tumor of the ovary of endothelial origin and, third, that the tumors of endothelial origin must be differentiated from sarcomas. Flaischlen[4] was the next one to report about sarcomatous degeneration of ovarian cysts, the microscopic picture being the same as that of Marchand's tumors. Flaischlen concluded that it was a malignant degeneration of a cystic tumor of connective tissue origin, combined with a dermoid cyst. Olshausen and Ackermann,[5] and Eickardt,[6] in 1899, showed a definite relation of the tumor cells to the endothelium of blood vessels, and described their tumors as endothelioma intravasculare. Eickardt[6] was also the first to prove the ability of such a tumor to metastasize. Mary Dixon Jones,[21] in 1899, described twelve cases of ''endothelioma'' of the ovary from a clinical viewpoint. None of these could be regarded as endothelioma, however, and they were probably carcinomas or sarcomas, while others were not true newgrowths (Kubo).[18] Pomorski,[7] in 1890, was the first to diagnose these tumors as endothelioma lymphaticum, although Marchand had previously stated the possibility of such origin. V. Velits[7] described a tumor which, on account of the microscopic findings, he classified as being derived from the endothelium of the lymph vessels. V. Rosthorn,[8] in 1891, described such a tumor as endothelioma perivasculare of the ovary, there being evidently immediate relations between the newgrowth and the blood vessels. J. A. Amann,[20] in 1894, in a study of five cases of endothelioma, concluded that these growths originated from the endothelium of the blood capillaries and the endothelium of the lymphatics and tissue spaces. Thus, Amann and L. Pick[9] give recognition to several types of endothelioma, depending on the structures from which they arise, such as lymphatic and vascular endothelium and perithelium. In the years 1895-1899, several papers were written about these tumors by Voigts, Herz, and others. Linck, in 1900, described a case of bilateral endothelioma lymphaticum cystomatosum. He reviewed the literature to date and was inclined to conclude that his case was a metastatic one from a gastric neoplasm. Haacke, in 1901, described an endothelioma of the ovary of lymphatic origin, and described some syncytial masses the origin of which was not given. Schlagenhaufer[10] (1902), Polano[11] (1904), Papaioannou[12] and others pointed out the close resemblance of metastatic ovarian carcinoma to endothelioma and fibrosarcoma. Papaioannou,[12, 18] in 1904, as a result of his observations on the prevalent views, classification and histogenesis of endotheliomas of the ovary, reported as follows:

1. Perithelioma, in the sense indicated by Amann, represents an independent tumor which belongs among sarcomas and which is derived histogenetically from the adventitial cells of precapillary blood vessels.

2. The tumors described as endothelioma cannot be regarded as carcinomas.

3. A great number of independent endotheliomas of both ovaries may be carcinomatous metastases from abdominal organs. Thus, grave doubts arose as to the existence of any genuine endothelioma of the ovary. R. Meyer[13] was disposed to discard the entire group, and Ribbert[14] (1912) states the extreme view that the endothelial origin of any ovarian tumor, while possible, is unproved. Ewing[1] states that the most conclusive features of certain endotheliomas is the relation of cell groups, inclosing blood masses, as in angioblastic sarcoma. While the teratomatous nature of these tumors cannot be disregarded (Wlassow),[1] still Sternberg and Monckberg[15] and Pfannenstiel[19] endeavor to establish and recognize such tumors in the ovary. Ewing[1] thus states that, while critical research fully justifies

the current scepticism regarding the endothelial nature of the endothelioma, so called, there is nevertheless a restricted group of ovarian tumors for which very strong evidence points to an endothelial origin. The evidence, besides a histologic one, is the peculiar clinical course and gross appearance. The macroscopic behavior of the tumors is very variable. At times they are solid, at times cystic, and at other times combined with different ovarian growths. It is very difficult to differentiate them macroscopically from sarcomas or carcinomas. While Olshausen[5] described them as rare ovarian cystic tumors, Pick[9] did not think that the cyst formation was characteristic of them and that they did not differ roughly anatomically from the solid sarcomas and carcinomas of the ovary.

The above reported cases show the following characteristics:

Type.—Thirty cases (57.6 per cent) were solid tumors, with some mixtures of small cysts which had a honeycombed appearance and were located in the brittle spongy tumor masses. They also showed hemorrhagic, necrotic, and often unilocular, multilocular and combination cysts.

Age Incidence.—The age incidence also shows a very variable picture, the youngest patient being seven years old, the oldest sixty-four. Altogether there were 2 patients less than ten years of age, 4 between eleven and twenty, 10 between twenty-one and thirty years, 8 between thirty-one and forty years, 14 cases between forty-one and fifty years, 9 between fifty-one and sixty years, and 3 cases above sixty. The fourth decade is the most favorable, although there is no marked disposition to be noticed from the above figures.

Location.—Twenty-five cases involved the right ovary, 21 the left, 5 were bilaterally advanced, and in 1 case the primary seat was not mentioned. In 1 case the formation was traced nine years back and in others only a little over a half year had elapsed.

Symptoms.—There are no specific pathognomonic symptoms. At times there are pain, pressure, ascites, and atypical formation of the genitals, but they cannot be used as clinical signs of surety. Malignancy is present, but not so marked as in carcinomas and sarcomas.

Metastasis.—Local and general metastases take place by blood and lymph vessels, but at times through implantation, so that the primary growth is sometimes difficult to locate. Frequently there are adhesions to neighboring organs; e.g., to the pelvic wall, intestinal loops, etc. No patients with bilateral tumors (Kubo[18]) have been reported as recovered, but unilateral tumors have been successfully eradicated by several operators (Pfannenstiel).

Pathology.—Microscopically,[1] Kubo's[18] cases showed the tumor cells surrounding vascular channels which possessed a defined wall of normal endothelial cells, giving the structure of perithelioma. The tumor cells strongly indicate their endothelial nature. They are very uniform, small in size, cuboidal or rounded in form, pale-staining cytoplasm, and regular oval nuclei, with minute nucleoli. Mucinous and hyaline changes in these neoplasms are common.

CASE REPORT

E. W., colored, aged thirty-five, was admitted to Bellevue Hospital February 5, 1925, complaining of marked pain and swelling of the abdomen. One week previous to admission, the patient developed a dull pain in the lower right abdomen. After a day in bed, the pain disappeared and she was able to be about. Three days later, while at work, she was seized with sharp pains in the lower abdomen: the pains were both cramp-like in character and continuous. She stated that about one year previously she noticed a swelling of the abdomen, which had increased considerably during the week preceding the onset of pain. The family, medical,

and surgical history were irrelevant. Menstruation was established at fourteen years, was of the 28-day type and of four days' duration; there was no pre-, co- or post-menstrual pain. A period of amenorrhea occurred from 1917 to 1923, the cause of which was unknown. From 1923, the periods were irregular, appearing every six to eight weeks and lasting from two to ten days. The last regular period was on January 24, 1925, lasting seven days. The patient was delivered of one child eleven years previously, labor and puerperium being normal: no history of abortion.

On admission, the patient appeared to be acutely ill and physical examination disclosed a markedly distended abdomen. A midline tumor, extending 4 cm. above the umbilicus, was readily palpable. It was tense, regular in outline and tender; the greater part of it occupied the right half of the abdomen. Vaginal examina-
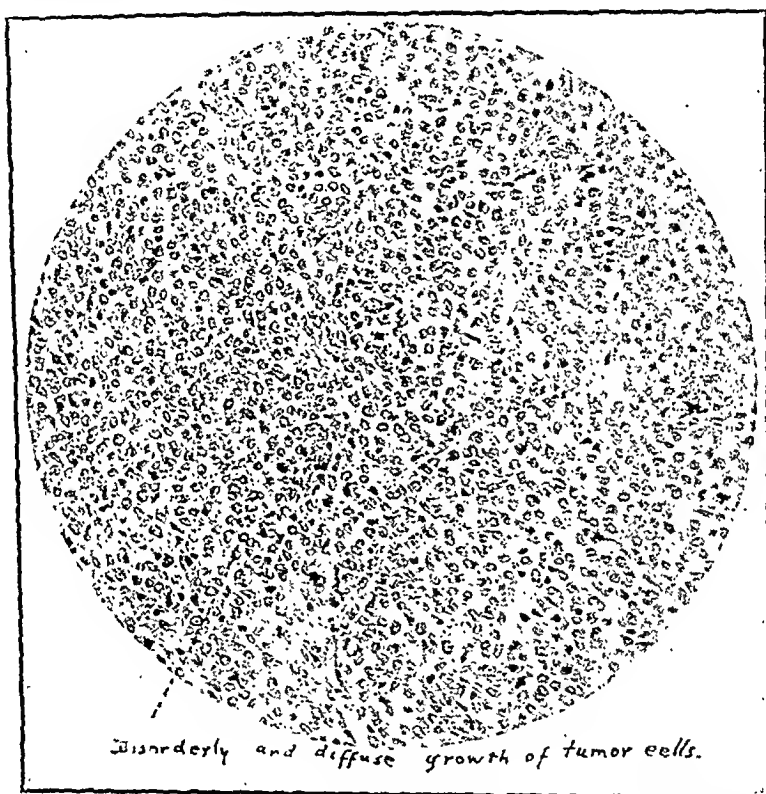
Fig. 1.—Disorderly and diffuse growth of tumor cells with practical absence of blood vessels.

tion showed a good parous pelvic floor. The cervix which was soft and slightly patulous, was in the axis of the vagina. The fundus was apparently posterior and its size could not be made out. The mass seemed to occupy the right abdominal cavity and extended slightly to the left, lying anteriorly to the uterus. It was partially movable. No definite pathologic condition of the adnexal could be detected by palpation. On rectal examination, the uterus was found retroverted and small, with the large tumor in front.

Temperature on admission was 101° F., pulse 120, respiration 22. Urine showed a trace of albumin, few hyaline casts; and many pus cells. Blood count showed leucocytes 12,000, polymorphonuclears 90 per cent, lymphocytes 10 per cent. Wassermann test was negative. Blood pressure was 100/60.

A provisional diagnosis was made of ovarian cystoma with a twisted pedicle, possibly infected.

Operation.—Operation was performed February 6, 1925, and disclosed a large ovarian cyst, arising from the right side, about 16 to 18 cm. in diameter, with a large rupture of its anterior surface, about 10 cm. long, through which old blood clot protruded. There was a complete double twist of the pedicle. The right tube was adherent to the mass. The peritoneal cavity contained about 1500 c.c. of thin serosanguineous fluid, but there was no evidence of peritonitis or of infection. The uterus and left tube were normal. The left ovary was small, presenting an old peri-oophoritis, with a thickened tunica. The cyst had a spongy feel, as if it contained clotted blood.

A right salpingo-oophorectomy was performed in the usual manner and the serosanguineous fluid drawn off. A two-point suspension was performed on the retro-
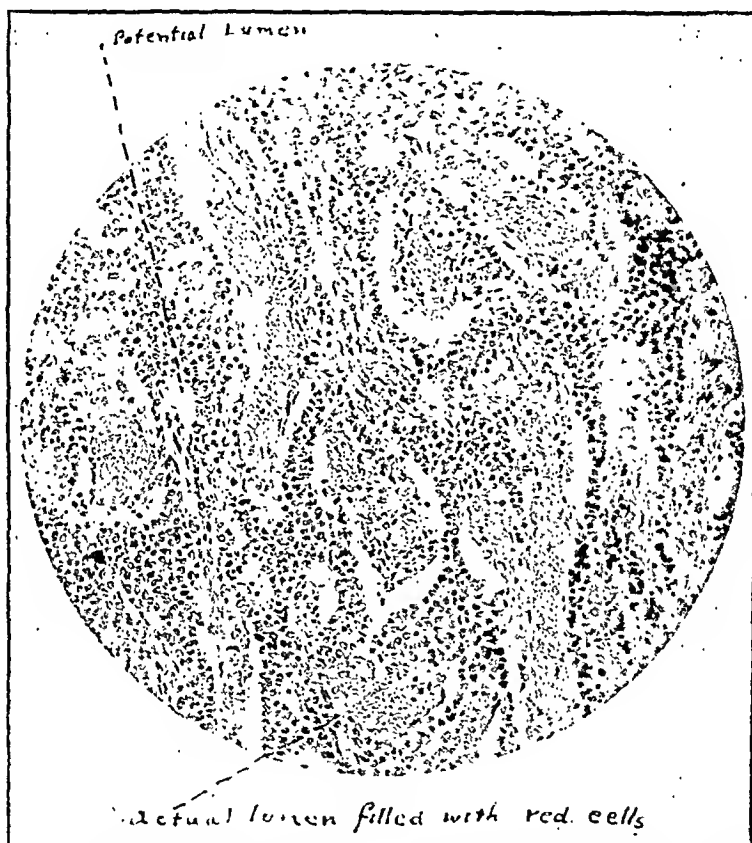
Fig. 2.—Shows the formation by the tumor cells of potential lumina and actual lumina crowded by red blood cells.

verted uterus. A clysis of 1000 c.c. of normal saline solution was given at the time of operation. Postoperative course was normal and the patient was discharged sixteen days later.

Pathologic Report.—Specimen consists of a large, globular, multilocular, cystic but firm mass, measuring 20 cm. in diameter, on one surface of which is an apparently normal appearing uterine tube. The serosa of the mass is glistening, deeply injected and hemorrhagic. The mass is filled with clotted blood and the inner lining is thrown into folds, dividing the tumor into several small and large divisions (lobulation). The lining membrane of the spongy, brittle tumor mass is smooth and glistening. The clots are easily separated from the lining. There is no evidence of the presence of any corpora lutea or graffian follicles. Thus,

while at operation the mass appeared to be an ovarian cystoma with twisted pedicle and secondary hemorrhagic changes, it later was found to represent the transformation of the entire ovary into a vascular neoplasm.

Microscopic Description.—(By Dr. Douglas Symmers, Director of Laboratories, Bellevue Hospital.) The histology of the tumor is complex. The cellular unit consists of a rather small rounded cell with a small amount of pinkish staining cytoplasm and a relatively large, rounded but poorly chromatic neucleus. When subjected to reciprocal pressure, these cells assume a short spindle- or oat-shaped form. In places, the tumor cells grow diffusely without any attempt whatsoever at orderly formation. In such areas blood vessels may be practically absent, while in other such areas, among the diffusely growing cells, are to be made out striking numbers of thin-walled blood vessels, lined by flattened cells, evidently derived directly from those of the tumor itself; the vessels being crowded by red blood corpuscles. In still other parts, the growth is provided with a richly cellular, rather mature connective tissue stroma, imbedded in which are numbers of long, narrow cellular islands, most of them composed of cells which are arranged in parallel rows and, of these, considerable numbers appear to be around a potential lumen, while others form the external limits to actual lumina. In still other instances, the lumen goes on to a considerable degree of dilatation and shows the presence in it of red blood corpuscles.

Return Clinic Note.—The patient was seen on November 26, 1926, twenty-one months postoperative and appeared to be in perfect health. She reported that she was delivered of a normal child on December 21, 1925 and, at the time of her visit, was five months pregnant. Gynecologic examination revealed a five months pregnant uterus; the left ovary was not palpable. The general physical examination was negative.

CONCLUSIONS

1. Hemangio-endothelioma intravasculare of the ovary is a rare pathologic entity, only 5 cases, including the present one, being reported in the literature.

2. Endotheliomas of the ovary have a definite histologic picture.

3. Endotheliomas of the ovary, although not as malignant as sarcoma or carcinoma, behave, in general, like these malignant neoplasms.

4. Endotheliomas of the ovary cannot be differentiated clinically from sarcoma or carcinoma of the ovary or from other newgrowths of the ovary.

5. Although bilateral endotheliomas offer a poor prognosis as to cure, unilateral endotheliomas can be successfully treated surgically. (Pfannenstiel and authors' case.)

REFERENCES

(1) *Ewing, James:* Neoplastic Diseases, 1919. (2) *Leopold:* Arch. f. Gynäk. 6: 317, 1874. (3) *Marchand:* Habil-Schrift, Halle, 1879. (4) *Flaischlen:* Ztschr. f. Geburtsh. u. Gynäk. vol. 7. (5) *Olshausen and Ackermann:* Deutsche chir. v. 58: 1886. (6) *Eickardt:* Ztschr. f. Geburtsh. u. Gynäk. vol. 18: (7) *Pomorski and Velits:* Ztschr. f. Geburtsh. u. Gynäk. vol. 18. (8) *Rosthorn:* Arch. f. Gynäk. vol. 41. (9) *Pick, L.:* Berl. klin. Wchnschr. 1894, p. 1017. (10)

Schlagenhaufer: Monatschr. a. d. Grenzgebieten d. Med. u. Chir. 15: 1902. (11)
Polano: Ztschr. f. Geburtsh. u. Gynäk. 51: 1904. (12) *Papaioannou:* Monatschr.
a. d. Grenzgebieten d. Med. u. Chir., vol. 20. (13) *Meyer, R.:* Ztschr. f.
Geburtsh. u. Gynäk. 63: p. 318. (14) *Ribbert:* D. Care. d. Mensch., 1911. (15)
Sternberg, and Monckberg: Virchow's Arch., vol. 190. (16) *Pfannenstiel:* Veit's
Handb. 4: p. 372, 1908. (17) *Apelt:* Hegar's Beitr., vol. 5. (18) *Kubo:* Arch.
f. Gynäk., vol. 87. (19) *Pfannenstiel:* Verhandl. d. Gesellsch. Gynäk. 99: p. 319.
(20) *Amann:* Arch. f. Gynäk., vol. 46. (21) *Jones, Mary Dixon:* New York
Med. J., 1899.

117 EAST SEVENTY-SECOND STREET.

A REVIEW OF THE TREATMENT OF THE CASES OF PLACENTA PREVIA AT THE BROOKLYN HOSPITAL FOR THE PAST TEN YEARS.*

By WILLIAM F. NELMS, M.D., BROOKLYN, N. Y.

OUT of 9,000 obstetric admissions to the Brooklyn Hospital for the years 1920 to 1929 (inclusive), there were 44 cases of placenta previa, an incidence of one-half of one per cent. Of this number 19 were primiparae and 25 were multiparae. The types were represented as follows: marginal 26; lateral 8; central 10. Eighteen or 41 per cent of the cases were premature.

All of these patients gave a history of painless bleeding at some time before admission, with the exception of two. All were definitely diagnosed as placenta previa by direct manual examination after admission.

TABLE I. INCIDENCE. 1920-1929 (INCLUSIVE)

	PRIVATE	WARD	TOTAL	PER CENT
Deliveries			9,000	
Previas	24	20	44	½
Marginal	16	10	26	59
Lateral	6	2	8	18
Central	2	8	10	23
Primiparae	10	9	19	43
Multiparae	14	11	25	57
Prematures	10	8	18	41

There were four maternal deaths out of the series, giving a maternal mortality of 9 per cent. The fetal deaths numbered 30, or 68 per cent. Of these 16 were premature, giving a corrected fetal mortality of 32 per cent. Sixteen of the mothers had a temperature of 100.5° or over, for forty-eight hours or more after delivery, giving a morbidity of 31 per cent.

TABLE II. MORTALITY

	PRIMIPARAE	MULTIPARAE	TOTAL	PER CENT
Maternal	1	3	4	9
Fetal	12	18	30	68
Morbidity	5	9	14	31

As to treatment, each case was handled in one of the following five ways:

1. By rupturing the membranes to control the bleeding and allowing labor to progress normally, terminating spontaneously or by foreeps extraction.
2. By internal podalie version and immediate extraction.
3. By Braxton-Hicks' version and spontaneous delivery, or breech extraction later.
4. By cesarean section.
5. In one case by the introduction of a number 4 bag and low forceps extraction after the head had descended following expulsion of the bag. In this case the mother recovered, but the baby died.

A total of 15 cases were treated by the first method (see Table III). There were no maternal deaths, and all of the six fetal deaths were premature babies. Two of the patients, or 13 per cent, had a reportable temperature. All cases were of the marginal type of placenta previa.

TABLE III. TREATMENT BY RUPTURING MEMBRANES

	PRIMIPARAE	MULTIPARAE	TOTAL	PER CENT
Total cases	7	8	15	34
Maternal mortality	0	0	None	None
Fetal mortality	2	4	6	40
Maternal morbidity	1	1	2	13
Prematures	4	4	8	53
Marginal type	7	8	15	100

Seven cases were treated by the second method. The cervix was found to be almost fully dilated on admission in two of these. Three cases were packed until the cervix was over four fingers open before performing the version and extraction. In one case the cervix was dilated by the use of a bag and in the other this was done manually. (See Table IV.) There were two maternal and five fetal deaths by this method.

Of the maternal deaths the first was a para iii about eight months pregnant, who was sent into the emergency ward by an outside doctor, with a history of bleeding intermittently for the previous three weeks, and very profusely just before admission. On examination the cervix was one finger dilated. There was very little bleeding from the examination. A central placenta previa was felt. She was packed, with no bleeding through the pack. The next morning the cervix was fully dilated, and a podalic version and extraction through the placenta was done with very little blood loss. The patient died shortly after delivery during a saline infusion. The cause of death was attributed to shock.

The second case was a para iii, full term, admitted to the emergency ward with a history of slight bleeding for five days before admission. She had been examined

and packed vaginally by a doctor in her home. A central previa was palpated on removing the pack, and the cervix found almost fully dilated. A version was then done through the placenta, and a dead fetus was extracted. The uterus was held bimanually during the repair, and the vagina then packed with dry gauze. The pack was removed on the second day postpartum. On the third day the temperature was 102° and pulse 100. For the following eight days the patient ran a septic fever and died of puerperal sepsis. Anerobic blood cultures were positive for B. welchi.

TABLE IV. PODALIC VERSION. IMMEDIATE EXTRACTION

	PRIMIPARAE	MULTIPARAE	TOTAL	PER CENT
Total cases	2	5	7	15
Maternal mortality	0	2	2	28
Fetal mortality	2	3	5	71
Maternal morbidity	0	3	3	42
Prematures	0	1	1	14
Marginal type	0	2	2	28
Lateral type	2	0	2	28
Central type	0	3	3	42

There were sixteen cases treated by the third method. In all but five the cervix was open sufficiently to perform the version and pull down a foot. In the remaining five the vagina was packed until the cervix was open enough for this. (See Table V.) The fetal mortality by this method was 100 per cent; the maternal morbidity 37 per cent. Six of the cases were premature. There were two maternal deaths.

TABLE V. BRAXTON HICKS WITHOUT IMMEDIATE EXTRACTION

	PRIMIPARAE	MULTIPARAE	TOTAL	PER CENT
Total cases	7	9	16	36
Maternal mortality	1	1	2	12
Fetal mortality	6	10	16	100
Maternal morbidity	3	3	6	37
Prematures	2	4	6	37
Marginal type	2	2	4	25
Lateral type	3	2	5	31
Central type	2	5	7	43

The first was a private case, para xiii, sent in from the outside, who was in desperate condition from loss of blood. The membranes were immediately ruptured and a foot brought down after version. The patient died on the table during a transfusion. The baby was not delivered. The second case was a para ix, admitted to the ward with a history of slight bleeding for two days before admission. Examination revealed a central placenta previa. She was packed vaginally while an anesthetic was being started, and then a podalic version performed through the placenta and a foot brought down. Breech delivery was done later. The patient had a profuse postpartum hemorrhage and was quickly packed in the vagina. The hemorrhage appeared to have stopped. She was given pituitrin and put to bed. About one hour later she was bleeding profusely through the pack and more packing was introduced. Later the pack was found partially expelled and the patient bleeding profusely. She was repacked by vagina, and died one hour later.

Cesarean section was done in five cases. (See Table VI.) Two of these were ward cases in which an hysterotomy was done at four to five months. There was no maternal mortality. The only fetal deaths were the two premature hysterotomy cases. Maternal morbidity was 60 per cent. Classical cesarean section was done in two cases and the low operation in one.

TABLE VI.   CESAREAN SECTION

	PRIMIPARAE	MULTIPARAE	TOTAL	PER CENT
Total cases	3	2	5	11
Maternal mortality	0	0	0	None
Fetal mortality	1	1	2	40
Maternal morbidity	1	2	3	60
Prematures	1	1	2	40
Marginal type	3	2	5	100
Classical cesarean	1	1	2	40
Low cesarean	1	0	1	20
Hysterotomy	1	1	2	40

From Table III it would appear that most marginal previas may be satisfactorily treated by rupturing the membranes to control bleeding and allowing labor to progress normally with a good chance of saving the baby.

In the other types the plan of treatment would depend upon several factors, as the amount of blood loss before admission, the amount of bleeding upon admission, the period of gestation, the condition of the fetal heart, and general condition of the cervix as to dilatation, obliteration and rigidity. We feel that podalic version through the placenta, with the pulling down of a foot to control hemorrhage, is safer than attempting immediate breech extraction after version. By the former method our mortality was 12 per cent and by the latter 28 per cent. There is no hope for the baby by this method.

Douglas and Siegel[1] of the University of Maryland Hospital report a series of cases in which they state that their rule is to empty the uterus at once. In 34 cases they performed version and immediate extraction with four maternal deaths or a mortality of 11.11 per cent and a fetal mortality of 61.11 per cent. The maternal causes of death were rupture of the uterus, shock, lacerations of the uterus and infection. After delivery they always pack the uterus.

As for cesarean section, our figures are too small for conclusions to be drawn from them. The policy at this hospital has been to consider the more conservative methods safer for the mother, and in the cases of lateral or central placenta previa with considerable hemorrhage to more or less disregard the baby.

In the recent literature, however, there are many writers who think that cesarean section is the best treatment for all types of placenta previa, claiming that it is a quicker and surer means of controlling hemorrhage, emptying the uterus, preventing postpartum hemorrhage, and at the same time saving the baby.

Douglas and Siegel[1] report 14 cesarean sections in their series, with no maternal mortality, but their fetal mortality was 90 per cent.

Greenhill[2] at the Chicago Lying-In Hospital gives the total maternal mortality in 118 cases treated by the so-called older methods as 2.6 per cent. In 42 cases in which cesarean section was done there were no maternal deaths. He advocates low cesarean section in all cases of lateral or central previa, with or without several hemorrhages and regardless of the condition of the child, claiming that by low cesarean section the lower uterine segment, where most of the postpartum bleeding occurs, can be carefully inspected and torn sinuses controlled by sutures. He states that in the past nine years about half the monsters found have been associated with placenta previa, but that he believes cesarean section should be done in these cases in the interest of the mother. He does not give figures for fetal mortality.

Kellogg[3] of Boston believes that all patients with central or partial previa should be treated by abdominal section, whether the baby is viable or nonviable, living or dead.

Bill[4] reports a series of 45 cases in which cesarean section and transfusion were not very frequent. The maternal mortality was 11.1 per cent. In another series of 56 cases in which 71 per cent were delivered by cesarean section he states that there was only one death or 1.7 per cent.

Essen-Moeller[5] of Sweden reports 20 cases of abdominal section with a dead fetus before operation in three cases. The one death was caused by embolism.

Korthauer[6] reports a maternal mortality of 50 per cent by version and extraction, 11.1 per cent by Braxton-Hicks' version and 6.9 per cent by cesarean section.

A few of the European writers advocate vaginal cesarean sections. Martin[7] reports 120 of these cases, with two maternal deaths, or 1.7 per cent mortality and 3.3 per cent fetal mortality. He states that the advantage of this method is that it can be done in potentially infected cases and in those with a high fever. Von Mikulicez-Radecki[8] reports three cases of vaginal cesarean section with one maternal death by infection.

Essen-Moeller did vaginal section 27 times with two maternal deaths and 17 fetal deaths. He states that the principal risk in this method is that the incision is not carried high enough in the cervix, so that it tears with delivery of the baby, and for this reason cannot be sutured properly. As a consequence postpartum hemorrhage may result. He uses vaginal section in cases where it is important to bring labor to an end, although the cervix is not fully dilated, and when abdominal section is contraindicated.

In conclusion, we may state that at the Brooklyn Hospital the routine procedure in marginal placenta previa cases is, first, to rupture the membranes and apply a tight abdominal binder. In most cases this will control the hemorrhage and labor will proceed normally. In those that continue bleeding, the vagina is packed, or a bag inserted, until the cervix is open sufficiently to perform a Braxton-Hicks' version, even though this may sacrifice the baby. Transfusion is always used when necessary.

We do not feel that cesarean section is indicated in every case of lateral or central previa. At least two of our deaths, namely, the patient with puerperal infection, who was packed outside the hospital, and the patient who died on the table from blood lost before admission, could not have been saved by cesarean section. If these two are excluded from the series our maternal mortality would be

only 4½ per cent which would compare favorably with many of the cesarean section series reported in the literature.

From an analysis of our cases we think that abdominal cesarean section should be used only in selected cases. We fail to see how cesarean section will control a hemorrhage, empty a uterus, and prevent postpartum hemorrhage in every case of placenta previa easier than a Braxton-Hicks' version with later delivery. We lost only one patient by Braxton-Hicks' version from postpartum hemorrhage, and feel that this case was not properly handled. The other patient treated by this method was infected from a source outside the hospital. Of the two remaining deaths, one patient was almost dead on admission from loss of blood, and the last was treated by version and immediate extraction, which method we now condemn, in preference to the Braxton-Hicks' version with later delivery.

The ideal case of placenta previa for cesarean section is, in our opinion, a full-term primipara, with a long, rigid cervix, with the baby alive and viable and in whom there has not been too much blood loss.

REFERENCES

(1) *Douglas and Siegel:* AM. J. OBST. & GYNEC. 15: 671, 1928. (2) *Greenhill:* Surg. Gynec. Obst. 50: 113, 1930. (3) *Kellogg:* AM. J. OBST. & GYNEC. 11: 194, 1926. (4) *Bill:* AM. J. OBST. & GYNEC. 14: 523, 1927. (5) *Essen-Moeller:* AM. J. OBST. & GYNEC. 15: 613, 1928. (6) *Korthauer:* Zentralbl. f. Gynäk. 51: 1434, 1927. (7) *Martin:* Monatschr. f. Geburtsh. u. Gynäk. 78: 61, 1928. (8) *Mikulicz-Radecki:* Arch. f. Gynäk. 123: 245, 1924.

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Wozak, J.: Prophylactic and Therapeutic Use of the Warnekros Serum In Cases of Puerperal Fever. Monatschr. f. Geburtsh. u. Gynäk. 81: 176, 1929.

In 1926 Warnekros, Louros and Becker reported on the use of a polyvalent streptococcus serum and since then reports have come from the Dresden clinic extolling the use of this serum especially as a prophylactic measure against puerperal sepsis. Wozak used this serum on 25 patients in seven of which the serum was given prophylactically. No difference was noted between these cases and 6 control patients who received no serum. However, in the cases where the serum was given therapeutically, some benefit was observed. The serum does not replace the other modes of treatment, it simply aids them.

J. P. GREENHILL.

THE PLACE OF THE PORRO OPERATION IN
MODERN OBSTETRICS

By Samuel S. Rosenfeld, M.D., F.A.C.S., New York, N. Y.

THE transperitoneal, the extraperitoneal, and the drainage technics, employed in performing cesarean section, have saved the lives of many mothers and babies. The brilliant results obtained by these methods should not cause us to neglect an operation, which in the indicated case, is both life-saving and efficient. I have reference to the Porro operation, or as it is now usually performed, should be designated as cesarean section followed by supravaginal hysterectomy.

The ideal indication for the performance of cesarean section and supravaginal hysterectomy is found in a patient who has a frankly infected uterus, especially so, if she has reached the age where the childbearing period is about completed. By employing this operation, one is enabled to deliver a living child and at the same time remove a large, involuting, boggy, infected and partly necrosing organ, which, theoretically at least, should make for a low mortality and smooth convalescence.

The commonly accepted indications for this operation are the presence of large fibroids where myomectomy is unsuitable, uncontrollable hemorrhage at the time of cesarean section, rupture of the uterus, tears or lacerations of the uterus inflicted during attempts at delivery, especially when infection is present. Osteomalacia is also regarded as an indication for supravaginal amputation.

The following cases will illustrate the type of patient in which the author favors the Porro principle:

Case 1.—Mrs. F. C., aged forty-three, born in Italy, gravida xi, para vii. Her periods were regular and the last was in June, 1928. All labors had been difficult. The fifth child was delivered by craniotomy and the sixth died twenty-four hours after a difficult forceps delivery.

I saw her for the first time on March 22, 1928. She was in a private sanatorium and had been in active labor for three days. The membranes had ruptured on the second day of labor. She had had many vaginal examinations and her temperature was over 102° F. by mouth. The woman appeared toxic and stuporous. Examination showed a full-term pregnant uterus, vertex presentation head unengaged. The fetus was apparently of average size. The heart sounds were rapid but regular. On vaginal examination I found that the cervix was leathery in consistency and dilated to the extent of three fingers. The pelvis was contracted, of the flat rachitic type.

There were several ways in which delivery could have been effected. One could have waited until the cervix had become fully dilated and hoped for spontaneous delivery. I rejected this possibility as improbable. Then again, delivery might have been effected by completing the dilatation of the cervix manually and de-

livering by either version or high forceps. I regarded this method as too dangerous. The cervix and the lower uterine segment felt friable and impressed me as the type that would rupture on the application of any undue force. Craniotomy I rejected, because it would have been a difficult procedure in this paitent and the danger of uterine rupture was as great as in the case of either version or high forceps. In addition the fetus was alive. I seriously considered one of the transperitoneal cesarean operations but was deterred by the almost certain presence of a uterine infection. The fear of infection and the fact that the patient had living children and was nearing the climacterium made me decide to do a Porro operation. She was transferred to the Lebanon Hospital, and under spinal anesthesia I made a midline incision reaching from the symphisis to the umbilicus. After thoroughly walling off the abdominal cavity, the uterus was incised and a normal living infant delivered, weighing six pounds and eight ounces. I then performed a typical supravaginal hysterectomy by the clamp method. On cutting across the supravaginal portion of the cervix about a half ounce of pus welled up into the wound. Culture of this pus revealed the Streptococcus albus. Microscopic examination of the uterus showed that the mucosa and submucosa were infiltrated by numerus pus cells.

The abdominal wall was closed in layers, inserting two drains into the peritoneal cavity. The wound became infected, and broke down almost completely. The Bacillus coli and an undetermined streptococcus were cultured from this wound. The patient also developed a severe throat infection which was clinically diagnosed as Vincent's angina. In addition, she developed a thrombophlebitis of the right saphenous vein. Blood cultures were sterile.

She and her baby were discharged from the hospital in good condition.

I recently examined her and found the abdominal scar firm. There was no evidence of hernia. Pelvic examination disclosed no unusual findings.

CASE 2.—Mrs. D. G., white, aged twenty-four, para i, went into active labor four days previous to admission to Lebanon Hospital. Her membranes ruptured on the previous day. The blood Wassermann reaction examined in the hospital was 4-plus.

The patient was very obese, well developed, appeared exhausted. The radial pulse was very rapid and thready and the cardiac sounds of poor quality. The abdomen showed a very large full-term uterus, the fetal back was on the right side. The fetal heart could not be heard. The head was not well engaged. The pelvis was contracted, of the simple flat variety, the cervix fully dilated.

Because the fetal heart which had previously been readily heard and located by her family physician, could not now be heard, I decided that craniotomy was the best method of delivery. Craniotomy was attempted but the fetus was so huge it was impossible to deliver it. On examination a tear into the broad ligament was found. Immediate laparatomy done, the entire uterus was brought out on the anterior abdominal wall and removed unopened, by the clamp method. The peritoneal cavity was drained through the cervix by a cigarette drain. The abdomen was closed in layers.

Her convalescence and recovery were satisfactory, except for a painful right hip and knee which the orthopedist thought was specific in origin. She left the hospital in good condition.

2021 GRAND CONCOURSE.

POSTPARTUM CARE*

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THE importance of labor and delivery has overshadowed the prenatal and postnatal period with the consequence that the proper conduct of the obstetric patient before and after delivery has not been developed until recent years. Prenatal care is scarcely thirty years old and we have barely scratched the surface of its possibilities. Nevertheless, the conduct of pregnancy today constitutes one of the best examples of preventive medicine that the medical profession has developed.

The period following delivery, however, has not received the consideration and thought that it deserves as is evidenced by the fact that very little has been published concerning postnatal care and that mostly within the last ten years. Here then is still another field of preventive medicine that we should endeavor to develop more thoroughly. It is with the hope of stimulating interest in the conduct of the puerperium that this paper is written.

Two things stand out in the general consideration of postpartum care; one is the fact that an obstetric case cannot be divided into three separate parts—prenatal, natal and postnatal—and the other thing which must always be kept in mind is that although a careful and thorough routine is beneficial, each case must be treated individually if the best results are to be attained. We should also bear in mind the relative importance of each of the three divisions of an obstetric case. Labor and delivery should certainly receive the majority of our thought and attention for their potential dangers are by far the greatest.

IMMEDIATE PERIOD

The three great causes of maternal death in obstetrics are hemorrhage, infection and toxemia. The prevention of these three things, therefore, should occupy the foreground during the immediate period.

Hemorrhage.—At the Evanston Hospital during the last eight years out of a total of 6,679 deliveries we have had 153 cases where bleeding during or after the third stage of labor exceeded the average enough to be classed as hemorrhage. Our average estimated loss of blood is under 200 c.c.

We believe that one of the chief factors in preventing hemorrhage is the kind and amount of anesthesia administered during labor. If

the patient is delivered under ethylene or nitrous oxide, her uterus will have a better tonus. We also think that the administration of pituitrin at the beginning of the third stage of labor lessens the loss of blood. Scott[27] analyzed 2000 cases at the Evanston Hospital in half of which no pituitrin was used, while the other half received it. The average estimated loss of blood was reduced from 243 to 198. The prolongation of labor after the head has reached a safe level for outlet forceps and episiotomy will contribute to atony of the uterus. Retention of membrane or placenta also causes bleeding. Laceration of the cervix and all other damage to the birth canal we advocate repairing at the time of delivery.

If the uterus shows a tendency to soften and bleed, it should be massaged, all clots should be expressed and pituitrin or ergot or both administered. If bleeding continues, the uterus should be packed with gauze. The bleeding can generally be controlled by the above measures because, as Fieux has shown, it is generally venous in origin and under low pressure. The uterus should be packed early. A hemorrhage that has been stopped only after the pulse rate has gone up and the blood pressure has been lowered has been stopped too late.

A knowledge of the patient's blood condition before delivery will also help to prevent what seems at times to be a severe reaction from an average amount of bleeding. If a patient with severe anemia has been grouped and matched and we have a donor on hand, she will benefit by the saving of time if transfusion is needed.

Infection.—Every obstetric patient should be treated with the same careful aseptic technic as a patient requiring major surgery. The chief cause of infection is contamination or the introduction of pathogenic bacteria into the birth canal. It is to prevent such contamination that we use rectal examinations during labor. During the past year we have injected 4 per cent mercurochrome solution into the vagina preceding all vaginal examinations. Whether this has actually reduced infection we cannot say but it would seem reasonable to use it. Schottmueller, Schwartz, Diekman and Brown have all been able to demonstrate anerobic streptococci in the vagina and on the basis of this fact the injection of various nontoxic germicidal solutions into the vagina at the start of labor has been advocated.

Every precaution should be employed to prevent infection during delivery, however, and no careless or inadequately trained student nurse permitted to contaminate the patient as soon as she reaches her bed. The average hospital patient can be infected by about six different people, and it behooves the doctor in charge to be familiar with what goes on following delivery. No one with any infection, especially of the nose and throat or hands, should be permitted in an obstetric ward nor should the obstetric interns and nurses be caring for anyone

having an infection of any kind. The ideal situation in any hospital would be to have the infected cases, both obstetric and gynecologic, handled on a separate service.

The vulva should be treated as an open wound regardless of whether there has been a laceration or not. Sterile pads should be applied and changed after each urination and bowel movement or as often as is necessary. This question was asked in a recent questionnaire sent out by the author and Dr. Philip Smith in connection with the White House Conference on Child Health and Protection, and it was answered 158 to 1 in the affirmative. One hundred and forty-three out of 159 use pitcher irrigations also as a matter of cleanliness, comfort and prevention.

Another type of infection seen during pregnancy and the puerperium might be termed metastatic. Foci of infection in teeth, tonsils, sinuses and kidneys should be cleared up as early in pregnancy as possible. Such foci of infection contribute to abortion, pyelitis, mastitis and toxemia and it is not too far-fetched to assume that they may cause a puerperal fever. Here again we see the possibility of preventive medicine during the puerperium. A year ago, November 6, I instituted a routine full mouth x-ray examination as a part of the first prenatal examination. Since then 193 patients have come for the care of pregnancy. Forty-nine of these had had their teeth x-rayed within four months which shows they are a class of women accustomed to good dental care but out of the remaining 144, 28 were found to have abscessed teeth. Twenty-three of these women had extractions, 4 refused, and 1 had the abscess drained. Two of these x-rays led to the discovery of infected antrums, both of which were treated. Three patients had tonsillectomies during the first trimester. Last year 9 patients were tonsillectomized.

The treatment of puerperal fever is outside the scope of this paper as I desire to deal more with the preventive side of things. We feel, however, that the conservative treatment with rest, food, sunshine, posture for drainage, ergot and good nursing care will yield the best results. There are too many cases that are actively treated early in the disease where a cure is reported that probably would have done better if left alone.

Eclampsia.—Eclampsia occurs only about once in every five hundred private obstetric cases, which means that it is rather rare. On the other hand, our present-day statistics show that 26 per cent of the deaths in obstetrics are due to eclampsia. About one-fifth of the cases of eclampsia occur following delivery, the great majority of them within forty-eight hours. Eclampsia must be regarded as a preventable disease. Even the cases reported as having a very sudden and unexpected onset could be detected before convulsions occurred if those in attendance were alert. If the patient is toxic, local

anesthesia and narcotics should be used in place of a general anesthetic whenever possible. If the patient has shown evidence of toxemia prior to delivery, she should be treated as a case of eclampsia following delivery for at least forty-eight hours. She should have frequent blood pressure readings, a record of the intake and output of fluids, fluids abundantly by mouth or by vein, nothing but liquid diet and absolute rest with sufficient morphine, chloral and bromides to lower the sensitiveness of the central nervous system to where convulsion will not be apt to occur. If every case coming from the delivery room is observed carefully enough, there will be no eclampsia.

Sleep and Pain.—It is my practice to give morphine rather freely following delivery. It can be given during the repair or as the patient leaves the delivery table, considering, of course, any previous administration of narcotics. If later on during the first few days pelvic cramps, breast engorgement or pain in the wound is not relieved by the ordinary analgesics by mouth, morphine or codeine should be given by hypodermic. The patient should never be restless or kept awake because of pain. One of the most important factors in the recovery of the puerperant is sleep. None of our hospitals give the patient sufficient time in which to sleep and rest. I give my patients a sedative the first three nights with instruction to the nurse to give an additional dose if the patient is still awake. The two o'clock (A.M.) feeding is eliminated in all cases during the first week. In the questionnaire referred to before, 57 out of the 159 give a sedative routinely during the early puerperium.

Bladder and Bowel.—The bladder should never be allowed to become distended. One or two catheterizations to prevent distention are safer than repeated catheterization over a period of days because of the atony produced when a bladder is overfilled. We have the patient catheterized if at the end of twelve hours all attempts to get her to void have failed. She is not allowed to go even a few hours, however, if palpation or percussion shows her bladder is distended. Once a catheter is passed, it is very essential that there be no residual urine after the patient starts to void. Test catheterizations should be made to determine this fact. Here as in all other parts of postnatal care a certain amount of routine will help but better results will be attained if each case is observed carefully and treated individually.

Most men agree that castor oil or other cathartic following delivery is not necessary. Even the discomfort it produces and possible restlessness are sufficient to condemn it. McPherson[21] demonstrated ten years ago that fever is twice as prevalent among those getting castor oil compared with those who do not. We give our patients mineral oil each night and even this has to be discontinued in certain cases because of loose stool and discomfort. Those patients not having movements are given a soap suds enema but never more often than

every forty-eight hours. The diet probably helps to regulate the bowels as much as anything. The ordinary obstetric patient can have a full tray within twenty-four hours after delivery.

Involution of the Uterus.—Under the immediate puerperium I wish to include a few of the most important points concerning the involution of the uterus, for it is probably the most important physiologic change taking place during the puerperium. Miller[20] of Edinburgh reports the incidence of subinvolution there as being about 12 per cent.

Teacher[34] and Wormser[39] both show that the most important factor in the involution of the uterus is proper separation of the placenta and the complete removal of all the products of conception. This means that subinvolution of the uterus is to be prevented by proper conduct of the third stage of labor. They show that infection, either local or general, has very little influence on involution. The other factor next in importance is the position of the uterus. This will be discussed later under posture and exercise.

Anemia.—Every parturient should be examined a number of times for anemia not only because of the blood loss occurring at delivery but because the majority develop anemia during pregnancy and a very few develop a pernicious-like anemia either during the last trimester or the early puerperium. The three conditions which most commonly cause this lowering of the red cell count and hemoglobin are hydremia, destruction of erythrocytes in the placenta, and infection, especially foetal infection and syphilis. If dilution alone accounted for the anemia of pregnancy, the patients would not respond to treatment which a good many do and a certain number would not show a decrease in hemoglobin and red cells without hemorrhage during the two weeks following delivery when the hydremia is supposed to disappear. Nor will dilution explain the long-drawn out return to normal of certain cases where there was a normal blood picture prior to pregnancy and a severe anemia at term.

The condition of the blood should, therefore, be known at the time of delivery. We also take a blood count on the day after delivery, the twelfth day and the sixth or eighth week. I have studied about five hundred private obstetric cases from the standpoint of anemia and I know that enough of them respond to treatment to warrant giving it. Treatment is seldom instituted unless the hemoglobin is below 65 per cent (S.U.) or the red cells under 3,500,000. Liver extract, liver itself and iron are used as recommended by Keefer and Yang.[17] They have shown that liver and iron together are more effective than either one alone. Whipple[37] has also recently recommended the use of liver extract in the treatment of secondary anemia.

Posture and Exercise.—One of the most important parts of postnatal care is the exercise and posture prescribed. An obstetric patient

can very easily be too quiet although more commonly they are too active. The four things that we think are accomplished by posture and exercise are drainage leading to less infection, better circulation leading to better involution, prevention of thrombosis with its attendant danger of embolism and a general improvement of the skeletal muscle tone. We prescribe the back rest and face position the third day, the wheel chair the sixth, steps the ninth and the patient leaves the hospital on the twelfth postpartum day.

On leaving the hospital she is shown how to take the knee-chest position and told to use it at least twice a day for ten minutes until her final examination at six or eight weeks. As soon as bloody lochia stops, I give my patients bed calesthenics. The day she leaves the hospital, she is examined and a rectal examination is made. As in labor everything one needs to know can be ascertained with the rectal finger. I have seen several patients showing infection following vaginal examinations at the twelfth postpartum day, one of which came to operation later.

Posture will also prevent retroversion but just how important retroversion is during the puerperium has never been definitely proved by a well controlled series of cases. That it has some importance there is no doubt, for a few patients having retroversion bleed longer and stop bleeding shortly after the uterus is reposited. They have backache also which disappears when treatment is instituted. The majority or those having retroversion of the uterus, however, make a normal recovery in the normal length of time. Stacy,[32] Lynch, Plass, and Danforth[5] with the author have each reported one thousand cases where, among other things, the position of the uterus was noted and all four authors agree that 20 per cent of all women at the child-bearing age have a retroverted uterus. In our series of 1000 private patients, 144 had a retroverted uterus at the eighth week but only 19 of these complained of anything such as prolonged bleeding or backache following delivery. We think such cases should be treated by reposition of the uterus and insertion of a pessary. We believe that the uterus should not be dealt with manually, however, unless it is producing symptoms. Many cases of retroversion need not be interfered with in any way for they are symptom-free and make complete recovery in the normal length of time.

INTERMEDIATE PERIOD

This is the most neglected period of all. The patient cannot be out and about. She has been carefully watched through pregnancy and has had careful attention through labor and the two weeks following. She then finds herself fairly closely confined with the burden of a new responsibility and in this new responsibility she needs

intelligent help. Most of the problems the young mother must face after returning home are nursing problems that can be dealt with by a well-trained nurse who is in close touch with the obstetrician. The Visiting Nurse Association takes care of the poor and the rich can employ registered nurses but the average family must rely upon a relative or a practical baby nurse. The majority of these relatives and practical nurses are incompetent, which means that the advice and help given is not what it could be if a little intelligent supervision were added.

Visiting Nurse.—During the past two years I have employed a registered nurse to help me supervise the care of the patient from the time she leaves the hospital until she is again able to come to the office at from five to eight weeks. I have yet to hear of a patient who did not appreciate her help. She furnishes me with a daily report showing the patients visited and keeps a written record which is filed with the record of the pregnancy and labor. Her questions are numerous at times but are gladly answered, and she is instructed daily about the patient's care. She has, in turn, through her own supervision and instruction, organized a group of well-trained practical nurses. As her experience grows, she becomes better fitted to solve the problems that so often disturb the successful recovery of a nursing mother. She also visits the patient before delivery far enough in advance to help her in procuring proper equipment. She makes house calls, also, that are secondary to my own visits such as in cases of early threatened abortion, hyperthyroids confined for a time, and cases of early toxemia. She may also come to my assistance in cases of emergency. A more detailed report of this nurse's work is to be published later.

The final examination is generally made at the eighth week but if the visiting nurse has reported anything wrong, the patient is examined at the end of the fifth week. This examination should consist of a general physical examination and should include her blood pressure, urine, red cells, hemoglobin, weight, a bimanual pelvic examination and an inspection of the vagina and cervix with a speculum. Malposition should be corrected unless symptom-free. If a pessary is used, it should remain in place about two months and its position should be checked a few days after it is inserted.

The granular cervicitis so often seen at this time should be cauterized with the electric wire cautery after which the patient should take a daily douche for at least two weeks. These patients should be seen once a month and if needed, the cautery should be used again. They seldom need more than one cauterization and I have never used more than three. These cauterizations may be carried out even though the patient is given a pessary.

REMOTE PUERPERIUM

Cases needing care for many weeks following delivery are generally complicated by one of the following: tuberculosis, heart trouble, thyroid disease, urinary tract infection, nephritis, syphilis, or gonorrhea. Most of these patients call for the care of a medical consultant if the case is being handled by an obstetrician but it falls to the one in charge to be alert to their possibilities.

The last thing I wish to mention and certainly not the least concerns the old saying "for every baby a tooth." Bauer, Albright and Aub[2] have shown that potassium, magnesium, sodium, and chlorine can all be husbanded in the body but that calcium and phosphorus must be furnished in certain minimal quantities every day. They say that a certain amount of calcium must be excreted each day either because calcium is necessary to neutralize acids or because the calcium liberated by catabolism is not available for anabolism. They also show that this same calcium is not available for the fetus and that the calcium excreted during pregnancy is about the normal amount. Sherman[28] has shown that for every 70 kg. a man needs 0.45 gm. of calcium every day and suggests that calcium be added to the diet. The value of vitamin D, now available either in cod liver oil or viosterol, and its relationship to the assimilation of calcium has long been established. The recent work of Hanke,[40] however, at the University of Chicago brings out the very interesting fact that calcium and vitamin D are of no avail unless accompanied by a diet rich in vitamin C. He shows that caries develop in teeth because there is not sufficient vitamin C in the diet and not because calcium and vitamin D are lacking or because of any acid condition in the mouth.

Out of 191 cases that Hanke has studied (these were not pregnant women) only 17 were free from dental disorders and none of these 17 were eating a diet deficient in vitamins. The remaining 174 were all eating a diet deficient in vitamin C. He therefore prescribes a diet rich in vitamin C and the results which he has obtained are very striking.

Putting these known facts together then we may conclude that in order to protect the teeth during pregnancy and lactation we should not only prescribe calcium, vitamin D and sunshine but we should further insure the patient's health by *prescribing a diet which contains an abundance of vitamin C.*

REFERENCES

(1) *Adair, Fred L.:* Am. J. Obst. & Gynec. 9: 1, 1925. (2) *Bauer, Albright, and Aub:* J. Clin. Invest. 7: 15, 16, 1929. (3) *Brown:* Am. J. Obst. & Gynec. 22: 300-329, 1930. (4) *Bunzel:* Am. J. Obst. & Gynec. 7: 686, 1924. (5) *Danforth and Galloway:* J. A. M. A. 87: 826-829, 1926. (6) *Davis:* Internat. J. Med. & Surg. 43: 83-85, 1930. (7) *Davis, C. H.:* J. A. M. A. 87: 1004. (8) *Editorial:* J. A. M. A. 94: 1504, 1930. (9) *Epstein and Fleischer:*

AM. J. OBST. & GYNEC. 14: 360-63, 1927. (10) *Esch, P.:* Zentralbl. f. Gynäk. 45: 341-345, 1921. (11) *Frankl:* AM. J. OBST. & GYNEC. 6: 399, 1923. (12) *Goodall:* Studies from the Royal Victorian Hospital, XI, No. 3, Montreal, 1910. (13) *Hamilton:* Acta. Pediat. 922, 2: 1. (14) *Hamilton and Mariarty:* AM. J. Dis. Child. 36: 450, 1928. (15) *Hofbauer:* AM. J. OBST. & GYNEC. 17: 761-766, 1929. (16) *Huffman:* J. A. M. A. 93: 1698-1701. (17) *Keefer and Yang:* J. A. M. A. 93: 575-578. (18) *Litzenberg:* Am. Child. Health & Tr. 6: 101-106, 1929. (19) *Mayes:* AM. J. OBST. & GYNEC. 10: 61, 1925. (20) *Miller, D.:* Brit. M. J. 1: 717-720, 1929. (21) *McPherson:* Am. J. Obst. & Dis. Wom. 80: 698, 1919. (22) *Parker:* J. A. M. A. 89: 2083-85, 1927. (23) *Pepper:* M. Clin. North. Am. 12: 925-939, 1929. (24) *Polak:* AM. J. OBST. & GYNEC. 13: 432-46, 1927. (25) *Randall:* J. A. M. A. 93: 845-847. (26) *Royston, G. D.:* St. Louis, Mo. (Not yet published.) (27) *Scott:* Surg. Gynec. Obst. 43: 651-653. (28) *Sherman:* J. Biol. Chem. 44: 21, 1920. (29) *Sheahan:* Brit. M. J. 1: 273-275, 1930. (30) *Simmonds:* J. A. M. A. 88: 1047-1050. (31) *Stieve:* Zentralbl. f. Gynäk. 2706-2723, 1929. (32) *Stacy:* J. A. M. A. 79: 793. (33) *Tansinsin:* AM. J. OBST. & GYNEC. 18: 98-103, 1929. (34) *Teacher:* J. Obst. & Gynec. Brit. Emp. 34: 1-27, 1927. (35) *Watson:* AM. J. OBST. & GYNEC. 16: 536-546, 1928. (36) *Watson:* Canad. M. A. J. 17: 773-778, 1927. (37) *Whipple:* Am. Med. Sc. 5: 628-643, 1930. (38) *Widdows:* Biochem. J. 17: 34, 1923. (39) *Wormser, E.:* Arch. f. Gynäk. 69: 449, 1903. (40) *Hanke, Milton Theo.:* The Relation of Diet to General Health and Particularly to Inflammation of the Oral Tissues and Dental Caries (Otho S. A. Sprague Memorial Institute and Dept. of Pathology, University of Chicago).

OVARIAN CYST COMPLICATING PREGNANCY*

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THE purpose of this paper is to present the results of an analysis of the records of 83 cases of pregnancy complicated by ovarian cysts. Thirty-seven of the cases are from the records of the Sloane Hospital for Women. The remaining 46 were gathered from case reports appearing in the literature. Lutein cysts accompanying hydatidiform mole, and solid ovarian tumors other than dermoid cysts have been excluded as not being immediately pertinent to the subject.

From October, 1921, when the present system of cross-indexing in the record room of the Sloane Hospital was instituted, to January, 1930, a period of eight years and two months, 16,818 cases of pregnancy were seen at the hospital. Of this number, ovarian cyst as a complication was found in 33, an incidence of one in 509.6. This incidence is undoubtedly high, because of the character of the service from which it is derived.

McKerron, in 1903, published an exhaustive analysis of the cases in the literature up to that time. He collected a total of 1,290 cases, and found the incidence to be one in 2,500 pregnancies. Spencer, in 1920, collected a smaller series, 55 in number, but he does not give the incidence.

From the literature appearing from 1920 to 1926 I have collected 46 cases which were given in such detail as to fall in line with my study of the cases from the Sloane Hospital. Thus, the records of 83 cases of pregnancy complicated by ovarian cyst have been reviewed and analyzed. The present communication is the result of this study.

Age and Gravidity.—Among 80 patients whose ages were definitely stated, the average age was found to be twenty-eight years. Spencer found the average age of his 55 patients to be thirty years.

Of 79 patients, 35 (44 per cent) were primigravid, while 44 (56 per cent) were parous. The parous women had had an average of 2.2 babies and one abortion each before the pregnancy in which the cyst was diagnosed. Spencer found an average of nearly three babies per patient before ovariotomy.

There is, however, some evidence that ovarian cysts are prejudicial to conception. Souba so holds, and cites the greater frequency of ovarian cysts in nulliparous women as compared with pregnant or parous women. Simpson estimated that one in ten married women are sterile, while one in three and one-half married women with ovarian tumor are sterile. Dieulafe records 42 cases of sterility in young women in whom unilateral cyst of the ovary was found and removed, and of whom 33 became pregnant within three years after the operation.

Pathology.—In 83 cases the cysts were found to be bilateral in 4, and unilateral in 79 (95.2 per cent).

The character of the cysts in 68 cases was noted as being: dermoid in 33; serous in 21; luetin in 4; parovarian in 4; papillary serous cyst-adenoma in 1; and pseudomucinous cystadenoma in 5. It is rather striking that the number of the common pseudomucinous cyst-adenoma should be so small. To simplify this classification: the cysts were dermoids in 48.5 per cent of the cases, and of other varieties in 51.5 per cent. McKerron and Spencer, on the other hand, found other varieties to be roughly three times as numerous as dermoids.

Of 87 cysts (4 of the cases being bilateral), 45 (51.7 per cent) were found to be situated in the true pelvis, and 42 (48.3 per cent) to lie above the pelvic brim, in the iliac fossa or in the abdomen. This almost equal distribution as regards location is at variance with the findings of McKerron, who, in 1,290 cases, found only 327, or 25.3 per cent of the tumors in the pelvis. Two of the 87 cysts, noted as being pelvic when diagnosed, were seen to rise above the brim spontaneously, one before, and one during labor.

Of 40 cysts lying in the pelvis, 24 (60 per cent) were dermoids; 16 (40 per cent) were other sorts. While of 38 cysts above the brim, 9 (23.7 per cent) were dermoids, and 29 (76.3 per cent) were other sorts. This confirms the clinical fact that the cyst most likely to remain in the pelvis and to obstruct labor is the dermoid.

As to whether the coexistence of pregnancy causes an ovarian cyst to grow, the evidence seems to be contradictory. In none of the 37 Sloane cases was increase in size of the cyst noted, although 10 of the patients were observed for an average of forty-seven days each, in all stages of pregnancy. Among 46 collected cases, a gradual enlargement was recorded in 4, not counting sudden enlargement caused by torsion of the pedicle and hemorrhage into the cyst. Williams and Spencer found that pregnancy had no influence upon the growth of the cyst, while Patton found a rapid enlargement in 11.8 per cent of 321 cases, probably due in most cases to acute complications in the cysts.

Symptoms.—The symptoms met with were: discomfort, dyspnea and palpitation due to abdominal enlargement in the case of large cysts above the brim; bladder irritability and constipation, the mechanical effects of pressure upon the bladder or rectum; ascites; edema; a sense of weight in the region of the affected ovary, or a bearing-down sensation in the pelvis, in the case of pelvic tumors; pains or soreness above the pubis, in one or the other lower quadrant, or in the pelvis, due to peritoneal irritation from friction of the cyst, or to the stretching of adhesions, where these existed; and, in the presence of torsion of the pedicle with strangulation, symptoms suggestive of acute ileus, i.e., violent, constant pain, vomiting, intestinal distention, shock and collapse.

Tumors incarcerated in the pelvis, and not removed before the onset of labor, caused obstruction. On the other hand, the natural process as a result of which pelvic tumors oftentimes do not obstruct labor was illustrated in the two cases where the cysts were spontaneously pulled up out of the pelvis and above the brim, one as the uterus enlarged during pregnancy, and the other during the progress of labor. Tumors above the brim were seen to interfere with labor by preventing engagement, by deviating the axis of the uterus, and by causing prolonged labor.

Of 73 cases where the records bore on the point, 46, or 63 per cent, had subjective symptoms either during pregnancy or after delivery; the remaining 27, or 37 per cent, had none. In 26 (35.6 per cent) the symptoms were classified as being mild or moderate, and in 20 (27.4 per cent), as severe. The symptoms occurred antepartum in 41 cases (56.2 per cent), and postpartum in 5 (6.8 per cent). In other words, of 46 cases of pregnancy complicated by ovarian cyst which showed symptoms, these latter occurred after the termination of labor in 5, or 10.9 per cent, showing that although the hazard from an ovarian cyst is less after delivery than it is during pregnancy, it is by no means ended with the birth of the child.

In the causation of symptoms, the location of the cyst, rather than its character, seems to be the determining factor. Thus, of 38 abdomi-

nal tumors, 35 (92.1 per cent) caused symptoms, whereas of 37 pelvic cysts, only 11 (29.7 per cent) caused symptoms. As a corollary of this greater frequency of symptoms with abdominal as compared with pelvic tumors, and of the relative frequency of dermoids within the true pelvis and of other kinds of cysts above the brim, it follows that symptoms are caused by other varieties of cysts more than by dermoids. Thus, of 41 patients with symptoms where the character of the cyst was determined, it was found to be of other sorts in 29 (70.7 per cent), and dermoid in only 12 (29.3 per cent).

Complications.—Complications arising in the cyst itself were: torsion of the pedicle, hemorrhage into the cyst, suppuration, and adhesions. Adhesions alone are of little clinical significance, and may be considered a minor complication. On the other hand, torsion, hemorrhage, and suppuration are complications of major surgical importance. Some one or more of these occurred in 25 of the 83 cases studied, an incidence of 30.1 per cent. The time of occurrence was antepartum in 18 (21.7 per cent), postpartum in 6 (7.2 per cent), and intrapartum in 1. Maclean found some complication in 1 in every 4 cases of ovarian tumor complicating pregnancy. McKerron found the incidence of acute complications of the cyst to be 25 per cent during pregnancy, and 40 per cent in the puerperium.

Torsion of the pedicle occurred in 23 of 83 cases, a frequency of 27.7 per cent. It occurred antepartum in 18 cases (21.7 per cent), and postpartum in 5 (6 per cent). Of the 23 cysts so affected, 5 (21.7 per cent) were pelvic in location, while 18 (78.3 per cent) were above the brim; 7 (30 per cent) were dermoids, and 16 (70 per cent) were other sorts. Where the torsion was sufficient to cause strangulation of the pedicle, the condition was manifested by symptoms remarkably like those of acute intestinal obstruction. The frequency of the complication is given by different writers as varying between 9 per cent and 30.5 per cent.

Hemorrhage into the cyst was seen in 15, or 18.1 per cent, of 83 cases. It was seen antepartum in 10 of the cases (12 per cent), and postpartum in 5 (6 per cent). Of the 15 hemorrhagic cysts, 3 (20 per cent) were pelvic, and 12 (80 per cent) were abdominal; 1 (6.7 per cent) was a dermoid, and 14 (93.3 per cent) were of other varieties. The hemorrhage in most cases was found to be due to interference with the circulation of the cyst, caused by a tight torsion of the pedicle. A less common cause was trauma to the cyst, suffered during labor.

Suppuration of the cyst occurred in none of the 37 Sloane cases; it was seen in 1 of 46 collected cases, an incidence of 1 in 83, or 1.2 per cent. Older reports give a more frequent occurrence, the factor of difference undoubtedly being the greater frequency of ovariotomy during pregnancy in latter day practice. Many case reports are to

be found in older literature, the complication arising during prolonged labor or after delivery. Kynoch writes: "Axial rotation, rupture, and suppuration are prone to occur during the puerperium. Labor is the commonest cause of suppuration, infection being through genital tears or of intestinal origin." Patton found 6 cases of suppuration at or after labor in 95 cases treated expectantly, an incidence of 6.3 per cent. McKerron gives the incidence as 1.5 per cent during pregnancy, and 9 per cent during the puerperium.

Adhesions between the cyst and contiguous structures were found in 18, or 21.7 per cent, of 83 cases. This incidence of 21.7 per cent is comparatively low, Doran, in 15 cases, and Spencer, in 55, finding adhesions in 46.7 per cent and 47 per cent of cases, respectively. In 6 of the 18 cases with adhesions, torsion or torsion with hemorrhage was also seen. In the other 12 cases, adhesions alone were found, and were evidently the result of localized peritonitis, caused by simple friction of the cyst. The location of the cyst was pelvic in 8 (44.4 per cent) of the 18 cases, and above the brim in 10 (55.6 per cent) The character of the cyst was dermoid in 7 (38.9 per cent), and of other kinds in 11 (61.1 per cent).

Rupture of the cyst was seen in none of the 83 cases included in this study. However, instances of its occurrence abound in medical literature: witness the reports of Polak, Patton, Williams, McKerron and others. Its frequency is given by different writers as varying between 2.3 per cent and 13.6 per cent. Spencer reports an interesting case where a cyst was known to exist, where operation for its removal was refused, where, on the third day after normal delivery the patient went suddenly into collapse and died, from a spontaneous rupture of the cyst. Autopsy showed no torsion or other accident, save rupture, demonstrating the need of removing large cysts whenever and at whatever stage of pregnancy found.

Thus it is seen that, both as regards symptoms and as regards complications of the cyst, the potential danger to the patient from an ovarian cyst complicating pregnancy is not terminated with the completion of labor. On the contrary, the possible bruising of the cyst incident to labor, and the greater room in the abdomen and pelvis incident to delivery, and the rapid diminution in the size of the uterus postpartum, all go to make of the puerperium a time particularly liable to accident.

Diagnosis.—The diagnosis of ovarian cyst as a complication of pregnancy is frequently difficult to make. There may be no symptoms to suggest its presence. This is particularly true of small tumors lying protected in the pelvis. We have seen, in 73 cases reviewed above, that symptoms were entirely absent in 27, and that they appeared only after delivery in 5, leaving 41, or 56.2 per cent, of cases where symptoms were manifest during pregnancy. Moreover, the physical

findings are often misleading. Hard, semisolid dermoids, or cystic tumors made tense by pressure may be mistaken for fibroids. And the abdominal distention in the case of large, flaccid cysts may be erroneously attributed to hydramnios or to multiple pregnancy.

The diagnosis was made during pregnancy and before the onset of labor in 64 (77.1 per cent) of the 83 cases of this series. In contrast to this, McKerron, writing in 1903, says: "Eighty per cent of small tumors occupying the pelvis are found only upon pelvic examination in labor." The earlier diagnosis, with resultant more efficacious treatment in present-day obstetrics is the result of more general, careful antepartum care and examination.

Treatment.—The treatment in 82 cases, excluding one case where therapeutic abortion (and ovariotomy) was performed, lends itself to classification under three headings: (1) expectant treatment throughout pregnancy, under which are included cases of ovariotomy postpartum; (2) ovariotomy during pregnancy, and (3) cesarean section plus ovariotomy at term. Other methods of treatment, formerly in use, such as aspiration of the cyst, simple reposition, incision and drainage, induction of premature labor, vaginal ovariotomy, and intrapartum ovariotomy with subsequent delivery from below, are, I think, now quite generally discountenanced. Their limitations and disadvantages are obvious; their results will not be considered in detail here.

The comparative results of the three methods of treatment employed in 82 cases of this series are summarized in the accompanying table:

COMPARATIVE RESULTS OF THREE METHODS OF TREATMENT

	EXPECTANT TREATMENT	OVARIOTOMY ANTEPARTUM	CESAREAN AND OVARIOTOMY AT TERM
Cases	26	35	21
Abortion or premature labor	8	4	
Per cent	30.8	11.1	
Normally through pregnancy	18	29	
Per cent	69.2	82.9	
Gross fetal mortality	8	7	1
Per cent	30.8	20	4.8
Corrected fetal mortality	8	5	0
Per cent	30.8	14.2	0
Maternal mortality	0	2	0
Per cent	0	5.7	0

It is seen that 26 patients were treated expectantly, either because the presence of the ovarian cyst was not diagnosed during pregnancy, or else in the hope that such a cyst, known to exist, would cause no trouble. Eight of the patients so treated aborted or went into labor prematurely. Fourteen went through pregnancy, labor, and delivery without mishap, while in four the cyst caused dystocia during labor. However, in 6 of these 14 normal cases removal of the cyst was

urgently indicated early in the puerperium because of torsion of its pedicle. Altogether, 15 of the 26 patients treated expectantly had an ovariotomy postpartum. The fetal mortality in the 26 cases was 8, or 30.8 per cent, while the maternal mortality was nil.

In comparison with the above group, are 35 cases in which ovariotomy was performed during pregnancy. Twenty-nine of the 35 patients went normally to term and through labor following the operation. Abortion or premature delivery of a nonviable fetus followed ovariotomy in 4 of the 35 patients. Two patients died undelivered from pulmonary embolus, one on the second day, and one on the twenty-fourth day after operation. Thus, the maternal mortality was 2, or 5.7 per cent. The gross fetal mortality was 7, including the 2 babies dead in utero of the mothers who succumbed. If we deduct one patient in whom abortion was imminently threatened upon admission and before operation, and another where death of the fetus occurred four months after operation as a result of accidental hemorrhage in a patient with toxemia of pregnancy, this gives a corrected fetal mortality of 5, or 14.2 per cent.

Eight of the 35 cases of ovariotomy during pregnancy were operated upon before the termination of the third month of pregnancy. There resulted two abortions, of which one was definitely threatened before operation. In 6 patients the corpus luteum of pregnancy was found in the ovary removed at operation, 1 at two months, 1 at two and one-half months, 3 at three months, and 1 at four months. The first aborted; the other 5 went normally to term. In this connection, Grosse quotes Frankel's experiments with rabbits, in which destruction of the corpus luteum during the first fourteen days of pregnancy was regularly followed by abortion, whereas its destruction after that time usually caused no untoward result. This influence of the corpus luteum corresponds with its anatomic evolution. In women such experiments are not possible, but clinical evidence seems to point to the first two months as being the period during which the corpus luteum is indispensable to the continuance of pregnancy.

Twenty-one cases were treated by cesarean section and ovariotomy at term. The maternal mortality was nil; the fetal mortality was 1, a baby dead in utero upon admission after neglected, prolonged labor with a dermoid cyst incarcerated in and obstructing the pelvis. Elimination of this case, which was clearly one of neglect, gives a corrected fetal mortality of nil.

Upon the basis of these results, cesarean plus ovariotomy at term would appear to be the method of treatment of choice. However, to wait until the pregnancy reaches full term would be to incur the risk of symptoms caused by the cyst, and that of major complications to the cyst, which risks, in this series, amount to 56.2 per cent and 21.7 per cent, respectively.

SUMMARY

1. The presence of an ovarian cyst seems to militate against impregnation. However, it is not incompatible with normal pregnancy, labor, and puerperium.

2. At the same time, an ovarian cyst is a serious complication of pregnancy, which, in hospital practice, is met with in about one in every 510 cases. It is seen with almost equal frequency in primigravid and in parous women.

3. In this series of 83 cases, the cysts were almost equally distributed, as to their character between dermoids and cysts of other varieties, and as to their location between those lying within the true pelvis and those above the level of the brim.

4. Subjective symptoms were noted in 56.2 per cent of the cases during pregnancy, and in 6.8 per cent during the puerperium.

5. Major complications of the cyst occurred in 21.7 per cent of cases during pregnancy, and in 7.2 per cent in the puerperium.

6. Both subjective symptoms and cyst complications during pregnancy and the puerperium were far more frequent with abdominal than with pelvic tumors, and more frequent with cysts of other sorts than with dermoids.

7. Ovariotomy is indicated in every case of pregnancy complicated by ovarian cyst. It should not be done during the first two months of pregnancy because of the possibility of removing the corpus luteum. If the presence of the cyst is first diagnosed in the last month of pregnancy, one of two courses would seem to be indicated: either to wait until full term and then to do a cesarean and ovariotomy, rather than to subject the fresh cicatrix of a recent operation to the strain of labor; or else, if labor and delivery promise to be uncomplicated, to let them occur normally, and then to do an ovariotomy early in the puerperium. When the diagnosis of ovarian cyst is first made in the puerperium, ovariotomy should be performed forthwith.

REFERENCES

Anderodias and Lacouture: Gaz. Hebd. des Sciences Méd., Bordeaux 42: 405, 1921. *Anderodias and Lacouture:* J. de méd. de Bordeaux 51: 324. *Bartholomew:* Am. J. Obst. & Gynec. 5: 168, 1923. *Chaton:* Bull. Soc. d'obst. et de gynéc. Paris 11: 41, 1922. *Cumston:* Am. J. Obst. & Dis. Wom., N. Y. 50: 506, 1904. *Dambrin:* Bull. Soc. d'obst. et de gynéc., Paris, 670, 1920. *Darnall:* Am. J. Obst. & Dis. of Wom. 68: 981, 1913. *Davidson:* Tr. Edinburgh Obst. Soc. 42: 54. *Deverre:* Rev. franç. de gynéc. et d'obst. 15: 255. *Dieulafé:* Bull. Soc. d'obst. et de gynéc. 12: 598, 1923. *Doran:* Lancet, London 1: 356, 1902. *Dsirne:* Arch. f. Gynäk. 42: 416, 1892. *Fleming:* Am. J. Obst. & Gynec. 1: 270, 1920. *Fruhinshalz and Hamant:* Bull. Soc. d'obst. et de gynéc., Paris 10: 533, 1921. *Gilles and Gay:* Bull. Soc. d'obst. et de gynéc., Paris 9: 682, 1920. *Grosse:* Ann. de gynéc., Paris 13: 464. *Hamant:* Bull. Soc. d'obst. et gynéc., Paris 9: 588, 1920. *Hamant and Vermelin:* Bull. Soc. d'obst. et de gynéc., Paris 9: 616, 1920. *Haultain:* Brit. M. J. 1: 204, 1902. *Hellier:* Lancet, London 2: 1727, 1901. *Huter:* Bull. Soc. d'obst. et de gynéc., Paris 10: 369, 1921. *Jardine:*

Glasgow M. J. 54: 97, 1900. *Keller:* Bull. Soc. d'obst. et de gynéc. 13: 708, 1924. *Kickham:* Boston M. & S. J. 190: 660, 1924. *Kynoch:* J. Obst. & Gynec. Brit. Emp. 10: 270, 1906. *Laurentie:* Bull. Soc. d'obst. et de gynéc., Paris 12: 344, 1923. *Lea:* J. Obst. & Gynec. Brit. Emp. 6: 132, 1904. *Levy-Solal, Lelieure and Vignes:* Gynéc. et obst. 5: 70, 1922. *Little and Elder:* Canad. M. A. J. 10: 459, 1920. *Maclean:* Bristol Med.-Chir. J. 23: 40, 1905. *Macnaughton-Jones:* Tr. Obst. Soc., London 42: 140, 1901. *Macnaughton-Jones:* Brit. Gynec. J. 18: 216, 1902-3. *Massart:* Bull. et mém. Soc. Anat. 90: 176. *McKerron:* Pregnancy, Labor and Childbed with Ovarian Tumors, London, 1903. *Modlin:* Brit. M. J. 1: 1209, 1902. *Morse:* Lancet, London 1: 98, 1920. *Newell:* J. Tennessee M. A. 14: 121. *Orgler:* Arch. f. Gynäk. 65: 126, 1901. *Patton:* Surg. Gynec. & Obst. 3: 413, 1906. *Plauchu:* Bull. Soc. d'obst. et de gynéc. 9: 524, 1920. *Plauchu and Gaudon:* Bull. Soc. d'obst. et de gynéc. 12: 134, 1923. *Polak:* Brooklyn M. J. 19: 168, 1905. *Reeb:* Bull. Soc. d'obst. et de gynéc. 10: 444, 1921. *Riviere:* J. de méd. de Bordeaux 51: 132. *Robiolis:* Bull. Soc. d'obst. et de gynéc. 12: 255, 1923. *Schockaert:* Gynéc. et obst. 2: 369, 1920. *Schockaert:* Gynéc. et obst. 6: 349, 1922. *Simpson:* Clinical Lectures on Diseases of Women, Philadelphia, 1863. *Souba:* Minnesota Med. 5: 176, 1922. *Spencer:* Tr. Obst. Soc., London 43: 224, 1902. *Spencer:* Tr. Med. Soc., London 43: 126, 1920. *Spencer:* Brit. M. J. 1: 500, 1925. *Stiassnic:* Progrès méd. 35: 451, 1920. *Szymanowicz:* Gynéc. et obst. 6: 405, 1922. *Taylor:* Brit. M. J. 2: 1043, 1924. *Turnesco and Bulliard:* Bull. et mém. Soc. Anat. 90: 643. *Tourneux:* Bull. Soc. d'obst. et de gynéc. 9: 640, 1920. *Vallois and De Rouville:* Bull. Soc. d'Obst. et de gynéc. 14: 84, 1925. *Vanverts and Guenez:* Bull. Soc. d'obst. et de gynéc. 11: 785, 1922. *Vayssiere:* Bull. Soc. d'obst. et de gynéc. 10: 423, 1921. *Voron and Bouget:* Bull. Soc. d'obst. et de gynéc. 9: 543, 1920. *Williams:* Lancet, London 2: 129, 1897. *Zimmerman:* Internat. Clin. 1: 202, 1920.

3 EAST EIGHTY-SEVENTH STREET.

Brock, J.: Uterine Irrigation With Alcohol During the Puerperium. Monatschr. f. Geburtsh. u. Gynäk. 77: 3, 1927.

Most authors advise against irrigation of the uterus when there is fever during the puerperium. According to Brock, uterine irrigations are indicated where an infection is limited to the uterus, and the adnexa are uninvolved. If very little pressure is exerted there is no danger. Usually the irrigating fluid employed is a watery solution of some disinfectant but such solutions act superficially only and have no penetrating effect. The result is essentially a mechanical cleansing, and destruction of the bacteria which are on the surface of the uterine mucosa. Alcohol, on the other hand, acts not only on the surface of the uterus but also penetrates the uterine wall and destroys bacteria there also. The author irrigates the uterus once at the beginning of a septic infection of the uterus during the puerperium with one liter of a 40 per cent solution, and has always obtained remarkable results. The fever quickly subsides and the general condition of the patient improves rapidly.

J. P. GREENHILL.

Society Transactions

The Elderly Primipara. Her Pregnancy and Labor. A Study of Over Three Hundred Cases, by DR. JAMES K. QUIGLEY, Rochester, N. Y. (See page 234, February issue.)

Application in Forceps Extraction, by DR. PAUL T. HARPER, Albany, N. Y. (See page 280, February issue.)

Obstetrical Morbidity and End-Results, by DR. T. S. WELTON, Brooklyn, N. Y. (See page 263, February issue.)

DISCUSSION

DR. R. D. MUSSEY, ROCHESTER, MINN.—Dr. Quigley's observations on more than 300 first births by women more than thirty years of age should relieve the elderly primipara of her fear. However, as the age of the primipara advances toward forty years and more, the hazards to mother and infant are increased. Statistics gathered by the Children's Bureau of the Department of Labor show that among mothers who are less than twenty or more than forty years of age, maternal and infant death rates are higher. If I remember correctly, about 3 per cent of Dr. Quigley's patients were more than thirty-five years of age and that the large majority of his patients were between thirty and thirty-five.

The first factor is lowering of physiologic reserve. After thirty-five athletes usually lose in competition. Second, there is more or less replacement of the muscular tissue of the lower uterine segment and of the pelvic floor by fibrous tissue. Third, fibromyomas are more prone to develop in these patients. Twelve per cent of white women who are nearing the age of forty years have fibromyomas. Fourth, in this group hypertension is more evident. All of these factors add somewhat to the hazard of the mother and of the infant as the age of the mother increases.

Dr. Quigley appropriately brought out the fact that the necessity for cesarean section is increased among elderly primiparas; this is true because the elderly primipara is more likely to have fibromyomas. Several of Dr. Quigley's patients had fibromyomas. Another factor which gives weight to the advisability of cesarean section is that the age of these women lessens greatly the chances of their having other children if the first child is lost in a trial labor.

In a group of 1500 cases my colleagues and I found 48 primiparas (roughly 3 per cent) aged thirty-five years or more. Of these 48 patients, 7, or about a seventh, had fibromyomas; 17, or a little more than a third, had systolic blood pressures of 140 mm. of mercury or more, at some time in the course of pregnancy;

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*The current volume of the Association Transactions will contain the complete discussions which cannot be presented here for lack of space, as well as those papers which were unsuited to the pages of this JOURNAL because of their purely surgical character.

10 of these had enough albumin in the urine to be of significance, and 6 had to be hospitalized on account of preeclamptic toxemia. None of the group had eclamptic convulsions.

Dr. Harper has given an excellent, rather idealistic description of the application of forceps. There is no question but that the medical students should be taught that only cephalic forceps should be applied. However, there are several points that may be brought out in connection with application of forceps and with the other methods that may be used. If the head is arrested in the inlet there is usually some reason for this arrest; usually it is either because there is more or less contraction of the inlet, or because of malposition of the head. With an adequate pelvic inlet, unruptured amniotic membranes, and arrest of descent of the head, version may be the method of choice. If the inlet is moderately contracted, the membranes ruptured, the fluid drained out, and the uterus contracted, either application of forceps or conservative delay may be indicated. Members of an Association like this must remember that those who are taking care of the greatest number of obstetric cases are general practitioners, or, rather, those who are not, as a rule, especially trained in obstetrics. The emphasis must be laid on conservative measures of treatment for labor; these consist in delay, administration of sedatives and induction of analgesia. In many instances what would be a very difficult case for application of forceps will become a very easy forceps delivery when delay has permitted further descent and rotation of the head.

I do not think much difference from Dr. Welton's opinions on maternal morbidity can exist. I agree that a temperature of 100.4° F., for two consecutive days following the first twenty-four hours, does not prove true morbidity. However, it seems to be the best standard that has been reached. I believe that Dr. Welton's suggestion in regard to the formation of new standards should be very carefully considered by this Association and by obstetricians in general.

DR. ARTHUR H. BILL, CLEVELAND, OHIO.—I agree with Dr. Harper except that I would say that a true cephalic application can be and should be made in every case and this method should be taught to students and residents who are learning obstetrics. Our test as to the proper application is this: After the forceps are applied we insist that the anterior edges of the blades should be parallel to and equally distant from the lamboid sutures. If this is the case we have a true cephalic application. Between each traction we check this to be sure that there is no slipping of the blades and that we constantly maintain this application throughout the whole delivery.

The important question is when the forceps are to be used and when not to be used. There has been considerable discussion of the inlet arrest of the head. I dislike very much to hear a discussion of the kind of application that should be made in inlet arrest. I feel that the sooner we stop experimenting with forceps designed for the inlet arrest, the better off we will be. We should not use high forceps. I believe that podalic version has replaced high forceps. To classify these methods I would draw a line through the pelvic inlet and should say forceps are indicated when the head has passed through the inlet, but when the head is arrested in the pelvic inlet or is above it, podalic version is the procedure of choice, and the only instance where high forceps should be used is the rare case in which the uterus will not relax sufficiently to allow podalic version to be performed. Even these cases may be avoided because for the most part they are neglected cases where a podalic version could have been performed earlier in the labor. I would especially emphasize my opinion that the sooner we stop discussing how to do high forceps and devising new means for doing so, the sooner will better obstetrics be performed. I am thoroughly convinced that there is greater damage done by high forceps, than by podalic version.

DR. E. A. SCHUMANN, PHILADELPHIA, PA.—My own experience has been in accord with Dr. Quigley's, though I should say that in elderly primipara my percentage of nephritic toxemia has been rather greater. I am more than in accord with him as regards the apparently high percentage of cesarean sections and I think he really did not emphasize that point sufficiently. The older the primipara the more important becomes the baby. One should never follow the statement which has been made in high places that first babies are experiments to determine the proportion or disproportion of the head, because elderly primipara will not attempt a second child if the first has been lost. Therefore, I think the elderly primipara should be protected, and if it is felt that fatal damage may result from vaginal extraction, great care should be taken. Having very decided views upon the matter of the test of labor, I am rather in discord with this subject. A test of labor, in my experience, has resulted so frequently in rupture of the membranes, making the moment of election for cesarean section impossible, that I have come to believe that the skilled specialist should be able to determine for himself the probabilities of successful pelvic delivery before labor is instituted. I would myself be inclined to err on the radical side and perhaps do an elective cesarean section in a woman who might otherwise deliver herself rather than to have delivery fail in one patient where the moment of election has passed and in whom a traumatic and difficult labor followed, with the probable loss of the child.

Dr. Bill has so thoroughly covered Dr. Harper's paper that there is little to add except to remind the audience that Dr. Harper used one expression, "stern necessity." My own experience with all transverse arrests is that those cases that have not been under the care of an obstetrician during the early stages of labor come in with a head moulded out of proportion, the membranes ruptured long since, the patient probably febrile and the opportunity for anything but a high forceps, or perhaps podalic version, long since past. In these cases with the uterus in tonic contraction, podalic version is rather a risky operation except in the hands of masters. It should be practiced in a greater proportion of cases than it is, but it is in these cases usually that high forceps must be done. Most of us cannot apply the ordinary instrument accurately to the sides of the fetal head, especially if there be marked deflection. However, these cases are rare. At the University of Pennsylvania we have been using the Barton forceps, but only in the neglected type of high transverse arrest which I have described. Sometimes the application of a Barton forceps is a matter of great difficulty and gives us great concern lest the lower uterine segment rupture.

DR. J. F. BALDWIN, COLUMBUS, O.—I heartily approve of the opposition to high forceps. We do not at our hospital permit high forceps without a previous consultation. Generally the man who wants to use them is a man of immature judgment or little experience. I usually prefer cesarean section. But the surgeon should be thoroughly, conscientiously, honestly convinced that cesarean section is the best procedure in individual cases before it is advised. It is done altogether too frequently now all over the country.

DR. I. W. POTTER, BUFFALO, N. Y.—The trouble with the elderly primipara has always seemed to me to be that she had a fibroid uterus and if we consider that she has a fibroid uterus, or a toxemia of late pregnancy, after the first stage of labor why not deliver her by elective version? When I heard such papers on forceps, I am inclined to think more and more of the elective version. The forceps operation for me has got to be a very simple affair. I do not like high forceps, nor forceps applied with the head arrested at the brim. I have done a great many cesarean sections, probably more than you would agree should have been done, but I do not think the average elderly primipara should be left to herself after the first stage of labor is over, she should be delivered and I do feel that the elderly

primipara with a breech presentation should be sectioned. I think that is one of the indications for the use of cesarean section.

DR. C. S. BACON, CHICAGO, ILL.—The difficulty with changing our definition of morbidity is in the uncertainty that would arise about the statistics. If we wish to call cases morbid that are judged morbid by the practitioner, then we bring in the subjective element, and we have no agreement among different men. One practitioner will find 1 per cent or 2 per cent and another will find 10 per cent or 20 per cent. If we use the index of temperature, there is no possibility of having any disagreement. I quite agree with Dr. Welton that temperature is not alone sufficient but I think it would be unfortunate to give up entirely the practice of using the temperature index to judge results of different clinics.

In the discussion of dystocias in elderly primiparae as well as the dystocias that lead to forceps, attention has been given chiefly to the difficulties at the pelvic inlet. I believe that more frequent than difficulties at the inlet are those difficulties in the dilatation of the cervix. The cervix dilates with perhaps less readiness in the case of elderly primipara and the long labor is usually due to the slow dilatation.

The same thing is true in determining upon the use of forceps. High forceps with a small inlet should not be thought of. The most difficult question to decide is whether the cervix is going to dilate when labor is allowed to go on a sufficient length of time. It would seem that in this discussion the question of the readiness of dilatation should always be given an important place.

The Kielland forceps in any position of the head is, I believe, the forceps of choice. It can be applied to the head in a transverse position as well as in the oblique. This instrument is only for the midforceps operation and the low forceps but never for the high forceps.

DR. QUIGLEY (closing).—Dr. Harper more particularly made a plea for cephalic application of forceps. I do not believe in high forceps as a rule but in a multipara, when the membranes have ruptured, the Barton forceps does wonderful work with a cephalic application, in a transverse arrest in the brim.

I think Dr. Welton struck a note that we all appreciate because we have all been working at this problem of morbidity and not getting anywhere with it. I suppose that started with the idea of perhaps comparing the morbidity in the different methods of examination, rectal, vaginal, etc. The true morbidity of any patient depends upon her condition six months after delivery.

In my paper I tried to make it clear that there is a certain group of patients, elderly primipara, who should have a test of labor. I am certainly unable to prejudge any woman with a normal sized pelvis, without any complication such as toxemia or fibroids, and I do not think there is any way to know what is going to happen unless we give them a test of labor. If we section them without a test of labor we would be doing an unnecessary number of such operations, because we have been agreeably surprised sometimes in seeing a head engage after trial labor. As to Dr. Potter's version at the end of the first stage of labor, I would not do it. I think I would do a section on that patient if the head does not come down.

DR. HARPER (closing).—I did not come here to "sell" high forceps as an operation. I rarely do the operation. I think it has no place except in the oc casional case where a well-molded head has been down in the pelvis for hours, where the membranes have ruptured, where there is some retraction, and where version is out of the question. One has to do the occasional high forceps; but, in inlet arrest version is unquestionably the procedure of choice.

No more did I come here to "sell" the Barton forceps. And although Dr. Quigley believes the Barton to be a wonderful instrument, I dislike the thought of

what may happen when that anterior blade, inserted posteriorly, is swung around to the front. Under the circumstances, cord prolapse and partial placental separation are without doubt possible dangers.

I would stress the imperative necessity of teaching the idea that a cephalic application must be secured. I believe it is possible in every case. My students are advised that when an operative case is finished and the child bears forceps-pressure marks over other than the malar prominences, something other than a true cephalic application has been secured and that the case has been by so much imperfectly managed.

Dr. Polak spoke about developing the obstetric conscience. No bigger contribution can a teacher make than to strive constantly to develop this same ''obstetrical conscience'' on the part of those in his charge. Any full-grown can deliver a mother of a seven-pound baby one way or another; but little real credit accrues unless it is done properly. If our papers and our teaching are not idealistic, we will get nowhere along the line of lowered obstetric morbidity and mortality even with forty White House Conferences.

If our students are sent out appreciating the value of cephalic application in every case and knowing how to make it, there will be far fewer men fifteen years hence making poor applications and doing correspondingly poor obstetrics.

When forceps are used, of course the blades should be applied to the sides of the baby's head, and they should remain there until the head is about to be born. And when the latter event transpires, there should be no evidence of their having been placed anywhere else than at the sides of the fetal head.

Etiology and Significance of Necrosis of the Placenta, by Dr. T. L. Montgomery, Philadelphia, Pa. (For original article, see page 157, February issue.)

DISCUSSION

DR. J. R. McCORD, Atlanta, Ga.—I have studied about 3,500 placentas microscopically, particularly with reference to syphilis. I agree with Dr. Montgomery that the process he has described should be called a necrosis rather than an infarction. I have found this condition a vast number of times and feel that in a mature placenta it is something of a natural process. It is true that in the study of premature placentas we do not find this condition as we do in the mature or ripe placentas. While we have been taught that there is no definite histologic picture of a syphilitic placenta, there is a picture that does occur so often with syphilis as to make it be regarded as a syphilitic condition. I am not altogether convinced that the syphilitic placenta is an endarteritis.

DR. JAMES E. DAVIS, Ann Arbor, Mich.—The only objection to Dr. Montgomery's theory might be that he has perhaps narrowed the cause of the change too much. One should check his impressions by applying broad biologic principles rather than taking up the exact end-changes that are seen under the microscope. It is perfectly reasonable to believe that fibrin is actually the contact agent, or the last agent that is at work producing these results, but back of the fibrin formation it would seem that one would have to give considerable attention to the status of the walls of the circulatory system.

The placenta in a broad sense is a decidual organ and when it reaches the stage of maturity it does not differ in ageing changes from any other tissue, or from the whole body, when it has reached the end of its physiologic existence. The processes that one observes are ageing processes, and are fundamentally vascular in type. It must be admitted that the actual agents that produce certain changes are the constituents of the blood, but when we describe the process

in terms of larger units of the body it seems that one should attribute them predominantly to the circulatory system.

I agree with Montgomery rather than with Williams in regard to the origin of the change, for it fulfills a fundamental rule in pathology. The more distal tissues, as a rule, will necrose earlier than the more proximal tissues for the very obvious reason that they are less adequately supplied with blood. Also the last formed tissues will be the first to degenerate, thus supporting Dr. Montgomery's contention.

DR. MONTGOMERY (closing).—One of the principal points in question in the consideration of this problem is the source of the necrotic changes in the placenta, whether they arise from the maternal or the fetal circulation.

We have brought evidence to indicate that the changes originate from some constituent of the maternal blood. We refer again to the points which have been suggested by Young and others, which demonstrate that the nutrition of the villous syncitium is not derived from the fetal placental circulation.

In the course of our paper we have conjectured as to the source and nature of the constituent of the maternal blood which causes necrosis. However, this phase of the problem requires further experimental study.

We are particularly opposed to the term "senile" as applied to the changes in the placental vessels, feeling that the collapsed state of certain vessels which suggests this appearance is secondary to necrosis of that portion of the placenta to which the vessel terminoles were distributed.

Nonspecific Vaginitis,* by Dr. W. H. Condit, Minneapolis, Minn.

Vaginal Repair, by Dr. A. J. Rongy, New York City. (See page 269, February issue.)

DISCUSSION

DR. DAVID HADDEN, Oakland, Calif.—Dr. Rongy has emphasized the all too frequently overlooked facts regarding variations in pelvic structures, and it is these variations that must determine the methods of repair. The skillful and successful surgeon is the one who is able to adopt one method of repair to the case in hand. Any operation that has a rational foundation and that is based upon a thorough knowledge of the anatomy is capable of being made applicable to any type or degree of injury.

Dr. Rongy's preference for a median incision to enlarge the outlet should, I believe, be the preference of every obstetrician. It produces the least injury to tissus involved and consequently is the most easily repaired. If the incision is properly placed there need be no fear of injury to the sphincter ani. With the median incision we are dividing tissue along a central raphe and not cutting across muscle bellies as with a lateral incision. If the head and shoulders are properly controlled no injury to the sphincter need occur. If we fear extension of the tear produced, it is possible to direct the incision to the side of the sphincter which normally is only attached to the central tendon in the median line and has a definite cleavage line surrounding it laterally. The attachment to the coccyx in fact tends to retract it.

This last year I have had two patients who developed difficulty of intercourse because of pain. Both cases had an excellent result from an immediate repair. In one case the trouble appeared to be a spastic levator ani. Two deep novocaine injections into the muscle provided permanent relief. The other case was a vaginismus

evidently due to nerve constriction at the outlet. I made under local anesthesia a median incision through the mucous membrane, freeing it from the central tendon, and closing it horizontally. This also brought complete relief.

Drs. H. D. Furniss, E. L. Cornell, P. B. Bland, and C. S. Bacon also participated in the discussion.

DR. RONGY (closing).—I am convinced that the fallopian tubes have a definite relation to menstruation, because not infrequently have I observed a disturbance of the menstrual function after a surgical sterilization when the continuity of the fallopian tube has been disturbed. However, I find that the patient finally adjusts herself and the menstrual function becomes normal again.

Regarding the question of episiotomy as against perineotomy raised by Dr. Cornell, it is true that a large number of cases are not infected, but there is a definite small number of cases, which become infected subsequent to the episiotomy operation. It is these cases that I have in mind when they have to undergo secondary repair. The anatomy in such cases is much more distorted and it is more difficult to repair them than those patients who have had a median perineotomy.

Now, as to the more important phase of the subject: If the present conception of labor is to remain unchallenged, we shall have an increased number of cases of vaginal vault damage. The mechanics of labor, properly conceived and correctly interpreted, is not that of an algebraic progression of diameters of the fetal head in the pelvis, but of a geometric coordination of the fetal head and the pelvic basin during the entire progress of labor. This fundamental difference in the conception of the mechanism of labor accounts for much of the incompetent management in cases of malposition and malpresentation. If this point once is properly understood, the only logical forceps application is the cephalic application. Any deviation from that will cause great damage to the soft parts. The oblique application or the pelvic application may be utilized occasionally as a corrective measure, but the child's head must not be delivered except by a cephalic application.

The Joseph Price Foundation Lecture was given as a moving-picture demonstration by Professor Jean Louis Faure, University of Paris, France, in which he illustrated his method of performing hysterectomy for fibromyomata.

President's Address: **The Romance of the Abdomen,** by DR. EDGAR A. VANDER VEER, Albany, N. Y.*

The Treatment of Hyperemesis Gravidarum, by DR. H. B. VAN WYCK, Toronto, Canada.

Venoclysis, by DR. W. T. McCONNELL, Louisville, Ky.

Observations on Toxemic-Nephritic Group Cases With Especial Reference to Classification, by DR. FOSTER S. KELLOGG, Boston, Mass.

*The President's Address will be published in the current volume of the Association's Transactions.

DISCUSSION

DR. PAUL TITUS, PITTSBURGH, PA.—Dr. Van Wyck in discussing treatment made a significant statement when he said in effect that any effort to draw distinctions between the various manifestations of toxemia at one time or another during pregnancy resolves itself merely into a classification of symptoms. I, too, am becoming more and more convinced that there is a definite relationship between all of the supposedly different toxemias of pregnancy.

In speaking of the intravenous use of dextrose in the treatment of these conditions both Drs. Van Wyck and McConnell referred to the possibility of overstimulation of the pancreas by overdosage of dextrose, thereby causing hyperinsulinism reactions. Dr. McConnell's fourth slide shows graphically the production and the prevention of this phenomenon, and is in correspondence with my own studies on the therapeutic dose of dextrose, published some time ago.

By making frequent blood-sugar readings during an intravenous injection of dextrose given at the maximum physiologic rate of Woodyatt, Wilder and Sansum (0.8 gm. per kilo body weight per hour) we found that the blood sugar first rises, then remains stationary for a time and then begins to fall quite rapidly. This we assumed to be the point at which an excess of endogenous insulin was beginning to be produced, and we concluded that the amount of sugar given up to this point (usually about 75 to 100 grams) represented a single, safe therapeutic dose. This is illustrated in the upper curve of Dr. McConnell's chart, and is being given there by the so-called intermittent or single dosage method.

By the continuous method, or venoclysis, this same overstimulation of the pancreas would probably occur, except that the rate of injection is so reduced or slowed that, as seen by the lower curve of this chart, there is never an excessive rise in blood sugar and likewise the corresponding fall from hyperinsulin production is lacking.

The secret of success from this method depends upon its being given several times more slowly than the same strength solution could be given by the single dosage method. This probably accounts for Dr. Van Wyck's excellent results.

Formerly I had preferred the single dosage exclusively but now use both methods according to indications and needs. Dextrose by venoclysis has an important therapeutic rôle but there are only a comparatively few patients who do not respond to the more simple single doses, frequently repeated. Whenever it is necessary we do not hesitate to cut down on a vein and use a cannula, but naturally one prefers to use a simple needle injection if possible.

An instrument developed in my clinic for intravenous dextrose injections, has on its dial valve not only the orifices for proper flow-rates for dextrose solutions of varying strength, but also one for this other method termed venoclysis. I mention this to indicate how important I now consider this method as an addition to the single dosage method.

DR. J. N. BELL, DETROIT, MICH.—Dr. McConnell mentioned introducing fluid into the peritoneal cavity but did not enlarge upon it, introducing a trocar just below the umbilicus and pouring water in through a funnel and tube. The first case that I tried it on just received 2000 c.c. of sterile water. That patient was about five and one-half months pregnant and one injection relieved her. She recovered and could retain her food and went on with the pregnancy. In the next patient we introduced 500 c.c. of a 10 per cent solution of glucose with 1500 c.c. of water and that patient got well. Those are only two cases but they are significant in that they corroborate what Dr. Titus has brought out, that relief of dehydration and the feeding of glucose are very important things to resort to in severe cases where we are afraid of embarrassing the cardiovascular circulation by the intravenous

method. The fluid is thrown into the circulation and gradually picked up just as the patient needs it, by being absorbed slowly by the peritoneum.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—The instrument devised by Dr. Titus is as nearly perfect for injecting glucose as anything I have ever used. It saves the time of the nurse and doctor and is absolutely accurate.

Where the ambulatory patient shows a deficiency in urinary output, with rise of pulse rate and loss of weight, we should hospitalize the patient, give her the necessary quantity of fluid to produce diuresis and emptying the uterus will not be necessary. We have not done a therapeutic abortion for vomiting in over nine years. Furthermore, I want to say that the fear of producing insulinism is an overestimated danger. I have always felt, as Dr. Titus has stated many times, that nature was competent to take care of the excess of glucose and the excess is excreted in the urine.

The other point is in regard to Dr. Kellogg's paper. I do not know what is the matter with Boston women. Perhaps their toxemias are more severe than those found in our Brooklyn women for we are not having such hopeless results as a 20 per cent mortality in eclampsia. I agree absolutely with his classification. It should be adopted in order that we may study these cases and properly group them; we owe it to the woman to be able to tell her ultimately whether she should never become pregnant again and should be sterilized. We owe it to society to tell these people that they are bearing a child at the cost of kidney damage and chronic nephritics should be sterilized.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—A few words should be offered regarding the classification of the so-called nephritides. These remarks are fitting because within this year at Minneapolis there was held a very notable conference upon the kidney and its diseases. At that conference Vollhard of Frankfort-am-Main, Rethberg of Copenhagen, Snapper of Amsterdam, and representatives from many universities in this country devoted a continuous period of about twelve days to discussion of the problems of the kidney. There was lack of agreement concerning the nomenclature of certain phases of kidney pathology, particularly the so-called chronic nephritis and nephrosis cases. These terms were used almost interchangeably. Nephrosis means a *degenerative change*, in most instances beginning in the tubules of the kidney but *not strictly* confined to the tubules. We are in the habit of speaking of degenerative changes and calling them inflammatory. It has been claimed in certain statistics, that an acute glomerular nephritis is rarely recovered from, and yet we speak and write frequently of chronic nephritis and we define this disease as being *caused* by repeated acute inflammation of the kidney. Others say they are acute manifestations of degenerative changes occurring at different times. Now, I am of the opinion that a classification must be agreed upon to define these pathologic conditions by terms common to all.

Bell of Minneapolis has shown by *specific staining* methods, using azar-carmine, that glomeruli in an acute nephritis have their capillaries narrowed but not closed; in the chronic type the capillaries are *closed*. The stain will distinctly differentiate the stroma, the endothelium, and the *epithelium*, and one sees in these so-called chronic nephritides the closed capillaries in very many of the glomeruli. These changes are called inflammatory lesions and also degenerative lesions. Which are they? Judged by criteria *applied in pathologic changes* in other tissues, they are distinctly of degenerative character. But it is possible they were preceded by inflammatory changes yet there are usually insufficient data present for the recognition of a previous or active inflammatory change.

DR. E. D. PLASS, IOWA CITY, IA.—I *still* believe that the pernicious vomiting of pregnancy is essentially a neurosis. I have yet to be convinced that there is

a carbohydrate deficiency. I treat my patients as if they were neurotics and do not empty the uterus, and I lose very few patients. I do recognize, however, that there is a type of pernicious vomiting which if not toxic at the beginning develops toxic properties and leads to the death of the individual. I am frank to confess that I do not know how to differentiate those few individuals who will die. Early deaths in my experience have been uncommon but recently I have seen three patients die six or eight weeks after apparently complete control of what was, we presume, neurotic vomiting, because it responded to neurotic treatment with cessation of vomiting. These three patients all behaved very similarly. There was in each case some reason why they did not desire the pregnancy to continue, an essential factor, I believe, in the majority of cases of hyperemesis gravidarum. They were hospitalized, were not given glucose, but within a week or ten days had recovered to the point of eating full-sized meals and of resuming their activities, and were discharged from the hospital. Each of these individuals, between six and eight weeks from the time of discharge, returned in a moribund condition. The picture was that of a slight mental disturbance, a slight return of the nausea, never marked, no evidence of emaciation, no clinical or laboratory findings of note.

Two of these patients came to autopsy. In neither was there any lesion which the pathologist could offer as an explanation of death. There was no liver necrosis, although there was fatty degeneration of the liver. In one case there was a small kidney with some evidence of chronic nephritis. In the second instance there was a large kidney, more typical of the nephroses. We do not know yet how to classify those patients. They were not vomiting at the time of death, had none of the signs that we ordinarily associate with vomiting, and yet they had developed fatal symptoms a month and a half or two months after control of the initial attack of vomiting. In that connection I would like to ask Dr. Van Wyck what the pathologic picture is in the vomiting of pregnancy? The experience of all of us has been, no doubt, somewhat limited. I, personally, have seen but one patient die with vomiting of pregnancy who showed the textbook picture of central necrosis of the liver lobule, acute yellow atrophy of the liver.

DR. W. W. BABCOCK, PHILADELPHIA, PA.—Speaking rather apart from a chemical toxemia and referring more particularly to cases in which there is an infectious element, one wonders if by the introduction of saline solution into the blood possibly an impairment in function may occur. We know how innocuous physiologic salt solution is in the normal peritoneal cavity, but it has been very clearly shown that salt solution in contact with inflamed peritoneum interferes with phagocytosis· or the defense reactions of the peritoneum so that peritonitis is rendered more dangerous. So one cannot help but wonder whether after the introduction of large quantities of fluid into the blood stream, if the blood will be as potent in combating infection as it would without the admixture. Venoclysis should aid elimination in toxemia, does it reduce the bactericidal and antitoxic properties of the blood? I shall be glad to hear this question answered. In any case we should not forget the older and simpler method of introducing fluid under the skin. It is quite possible by hypodermoclysis to introduce 4000 to 8000 c.c. of salt solution containing from 2 per cent to 5 per cent glucose daily, and to continue this for five or six days. Of course, if the glucose or dextrose is in concentration irritation may be produced. From the subcutaneous tissues the salt solution enters the blood stream as blood serum and may thus maintain the more effective qualities of the blood in the presence of infection.

DR. H. B. VAN WYCK, TORONTO, CANADA.—The question of neurotic as against toxemic vomiting is something more than a mere academic thing. It profoundly influences our treatment. Dr. Plass's two patients died of starvation and de-

hydration. One wonders whether a fatal case of starvation need always have the same pathologic picture. Our experience with similar cases is fortunately limited. We have had in the metabolic ward in the last eight years two fatalities from hyperemesis, in both of which we were at fault as we did not recognize the urgent indications. In one of these the autopsy showed a centrolobular necrosis. The idea is distasteful to me that the patient can go to a fatal termination from the pure neurosis. An analogy springs to my mind. A patient with appendicitis is put to bed and recovers and because we cannot demonstrate tangible pathology, are we justified in saying that the case is one of neurosis? That may be a poor analogy but as some one has said, "When an analogy is perfect it is no longer an analogy but the thing itself." We must remember the essential definition of neurosis; that it is a condition which is amenable to suggestion.

With regard to what Dr. McConnell showed us about venoclysis, I feel that it justifies us in still further examining our methods of intravenous therapy. We felt that we were using the largest amount that was practicable. One might question the comfort that a patient would have with a cannula in the vein over a long period. We find such a patient sometimes gets very restless and requires morphia. At any rate we shall certainly try to increase the amount of fluid and glucose that we are giving. I feel that the ordinary Murphy drip or the burette method is to be commended rather than the more complicated apparatus.

I am also grateful for the suggestion of amytol, which will make it possible to prolong the administration of glucose.

DR. McCONNELL (closing).—The only discomfort complained of by these patients was in the arm. They are usually very restless. Most of the women in whom this method was used were seen in consultation late and, as Dr. Titus brought out, if the patient is treated properly during the early manifestations there is seldom any need of radical treatment. Very frequently one dose of glucose solution will be sufficient. In none of these cases where we used the continuous drip did we do so without having first tried the intermittent method.

In a recent case which did not respond to the dosage method, having severe reactions with each injection, although it was being administered very carefully, we attached this apparatus. Although going for three days, she showed no reaction or ill effects.

We saw two cases of insulin reaction where we had added insulin to our solution purely for experimental purposes. When the insulin was discontinued, the reaction disappeared and did not return. I think the insulin bugaboo is very much overrated, especially when the solution is administered very slowly and the rate kept so that the body can take care of it.

My principal object in undertaking this study was simply to determine the relative relation between the rate of injection of glucose and the variation in blood sugar resultant therefrom.

DR. KELLOGG (closing).—Especially interesting in the light of Berman's "cardio-vascular deficient" group, of which I have spoken, is what Dr. Davis said about so-called nephritis being a nephrosis and part of a general vascular degenerative picture. The time will come when we will need intimate nephritis and nephrosis distinctions for the perfection of our ultimate classification. With Stander, I agree that this time has not yet arrived.

At present we must view this problem of saving lives in the toxemias as the figures dictate. Except for small or selective series, these figures are 2.5 per cent maternal mortality for toxemia without convulsions and 25 per cent for toxemia with convulsions. This means only that, broadly speaking, the convulsion is an index of the severity of the underlying condition, not that the convulsion per se kills.

There is little question in my mind that eclampsia and toxemia differ in amount and quality in different countries and in different parts of the same country. The Eden classification, I believe, represents practically a prognosis from the autopsy table backward. Therefore, if you select cases according to this classification the mortality should be nil, whereas it is 2 or 3 per cent, showing that even that way prognosis is difficult. Our mortality in Massachusetts shown in a personal study of twelve hundred cases in three groups of 400 each is 25 per cent, 24.8 per cent and 50 per cent respectively, the first two in our own hands. The tabulated mortality in Stander's monograph of over 10,000 cases, by different authors, shows that, barring the Stroganoff series already spoken of, the shorter the series the better the mortality by both conservative and radical treatment. For instance, Dorsett with 38 cases reports a mortality of 5.3 per cent by the magnesium sulphate treatment. If my memory serves me, when his series was in the sixties, his mortality was about 9 per cent. I do not know what it is now but expect it will be higher with a further accumulation of cases. In any large series the mortality approaches 20 per cent and this in hospital practice by good obstetricians. It requires no imagination to think what it is outside of the good hospital. Therefore, because the momentary treatment of eclampsia appears so successful in Chicago, Brooklyn, Atlanta, Los Angeles, Pittsburgh, or Russia, I see no reason to change the opinion here laid down, namely that saving lives in toxemia depends chiefly on preconvulsive interference.

Some Observations on the Menstrual Disturbances of Adolescence, by DR. E. D. PLASS, Iowa City, Ia. (See page 205, February issue.)

DISCUSSION

DR. D. L. JACKSON, BOSTON, MASS.—Investigation into the field of causes and controls of the female sex cycle is opening new fields of probability and supposition daily. It gives those of us who work mainly on the clinical side, possibilities of treatment, hitherto unsuspected, not only in dysmenorrhea and amenorrhea and menorrhagia, but in the general development of the adolescent girl, sterility in the young woman and comfort for the older woman in the menopause.

At the present time research in this subject seems to center in the triumvirate of glands; the ovary, the pituitary body, and the thyroid gland. All seem to have a part to play in the female sexual and menstrual cycle as well as in the development of the woman from the girl.

Treatment by ovarian extract or by the follicular hormone derived from the corpus luteum seems to have been a disappointment and amounts to nothing save in women at or beyond the menopause. On the other hand, thyroid extracts and extracts or hormones from the pituitary body seem to exert great activity in the control of the sex cycle during the adolescent and reproducing period of life, particularly in the former. Difficulties are apparently more on the hypo than on the hyper side of the activities of these glands. The basal metabolic rate gives us an absolute measure of the activity of the gland in thyroid disease. This must be checked with physical findings and laboratory tests. No case of hypothyroidism sufficient to cause menstrual disturbance will fail to give a lowered basal metabolic rate. It must be remembered that the reading of a single basal metabolic rate test is not conclusive of the true rate. The patient must be accustomed to the test, as it is found that nervousness or excitement easily pushes a rate up ten points. Slightly lowered basal metabolic rates will also be found in pituitary disturbance (Cushing), in surgical castrates and in patients with a negative nitrogen balance; viz., a really low basal metabolic rate—minus 20 to minus 40—is thyroid,

but a minus 10 to minus 20 rate may be due to other causes. According to Lawrence and Rowe, we seldom get menorrhagia in hypopituitary disturbance but we do get disturbances of periodic variation and of the amenorrheic type. Dr. Plass found both amenorrhea and menorrhagia in cases of slightly lowered basal metabolic rate. If, in this series, some of the lowered basal metabolic rates were due to one of the reasons stated above, other than thyroid insufficiency, it would very likely account for the good results obtained with the administration of thyroid extract in menorrhagia and the indifferent results found in amenorrheic cases. In other words, the question of the true basal metabolic rate becomes most important in the nearly normal cases, and it is in these cases that the clinical side becomes of greatest help and must agree with the laboratory findings.

In regard to the pituitary gland and the effect of its secretions on the menstrual cycle, I cannot agree with Dr. Plass on the measurement of the sella as giving an indication as to the size of the pituitary gland. The sella itself can be measured with great accuracy but I am told by Dr. Sossman, who has charge of the x-ray department for Dr. Harvey Cushing at the Peter Bent Brigham Hospital, Boston, that the relation of the gland to its seat is in no wise a constant or accurate estimate. Dr. Plass also postulates that in adolescents the size of the gland is in relation to its activity and to this I must again take exception. For example, the thyroid of adolescents frequently enlarges, apparently an attempt on the part of the gland to supply a deficiency, but this in most cases results only in hypertrophy of the gland tissue without increase in secretion. In cases of pituitary disease we must combine our laboratory results with a careful history and physical examination to make the diagnosis and eliminate other possibilities, as we have no definite test to rely on as in the case of the thyroid gland.

DR. A. J. RONGY, NEW YORK CITY.—In each generation, it is authoritatively stated, there is about 12 per cent of marriages that are sterile. About 6 or 7 per cent of these cases are caused by definite inflammatory and infective processes of the genital tract. A small per cent of these sterile marriages are caused by neoplasm and malformation. However, 3 to 4 per cent of this group of patients are sterile because they have reached the limit of reproduction and are unable to procreate. This may be one of nature's ways of limiting the population. These patients fail to respond to any treatment, and remain permanently sterile.

Now, if we keep this point in mind, we will find that some of Dr. Plass's patients indicate that type of sterility. Since the onset of menstruation, the menstrual function in such patients is disturbed. They either have a scanty, irregular menstruation, or sometimes the reverse happens: they begin to bleed and the bleeding continues irregularly for over a period of weeks. A great number of these patients when they marry, are sterile. Such cases are a source of annoyance to every gynecologist, because he finds himself perfectly helpless to correct the constitutional disturbance, which results in irregular menstruation and low grade of fertility.

However, some of these cases, for a reason yet unexplained, respond to the treatment with small doses of x-ray. It is remarkable how, in some of these patients who have not menstruated for months and years, the menstrual function is reawakened and they begin to menstruate regularly after five or six such treatments. We have as yet no way of explaining the effect of the small dosage of x-ray upon the ovaries in these patients. Still, clinically we know that it must have some effect on the ovarian structure.

A few of these patients even become pregnant after a long period of disturbed menstrual function and sterility. I made a preliminary report of this type of cases before this Association three years ago. Since then I have treated a great many more patients and the results have been very encouraging.

DR. E. P. SLOAN, BLOOMINGTON, ILL.—Sixteen cases in fourteen families that were between the ages of fifteen and twenty-two years came under our observation in 1925 and 1926. Correction of their thyroid deficiencies has apparently been productive of much improvement in their general health, but their menstrual disturbances have not been markedly influenced. The average age at which menstruation appeared in fifteen of these girls was seventeen years and three months. One with an infantile uterus is not menstruating at twenty-two. After more than three years of careful treatment seven out of the fifteen have severe pain at the menstrual period only occasionally instead of severe dysmenorrhea every month. In the other eight cases any apparent improvement in regard to pain and disability that has occurred has been temporary. We attribute our disappointing results in these cases to the age at which their thyroid deficiencies were corrected.

We have studied twenty-four younger sisters of these girls, nineteen of which showed definite symptoms of hypothyroidism. Of these nineteen, nine were under eleven years of age, six were eleven to twelve years of age, and four were thirteen years of age when thyroid therapy was instituted. All those in this group in which the thyroid deficiency was corrected before the age of thirteen are now menstruating normally. The average age at which menstruation appeared was thirteen years and one month.

If the symptoms in these cases are due to retarded differential development of the uterus and ovaries from hypothyroidism, then it is obvious that we usually see the case too late to speed up differential development with the whip of thyroid therapy. It does no good to whip the horse after the race is run. The hypothyroidism in these cases is usually of only mild degree and for maximum results the diagnosis must be made before obvious symptoms appear. Considerable difficulty may be encountered in making an early diagnosis.

The basal metabolism test is of little assistance but, as Dr. Plass has suggested, valuable information may be derived from x-ray studies of the stage of development of the bones. But the diagnosis in the majority of cases must rest upon the personal and family history and physical examination.

DR. PLASS (closing).—I should perhaps explain that our postulation regarding the relationship between the size of the hypophysis and the sella turcica in adolescent girls was developed after we had adduced the evidence of such relationship here presented. We have not attempted to go beyond the correlation which we have shown and which is given to you for what it is worth.

In this report first metabolic rate readings were not used, all figures refer to second or third determinations.

I would also emphasize that we are dealing entirely with young girls. Whether there is any relationship in older women, with already established menstruation, between the amount of the menstrual flow and the size of the sella, I cannot say because we have limited our work to girls in the adolescent period.

The Present Status of Tubal Insufflation With a Description of a New Method, by DR. Q. U. NEWELL, St. Louis, Mo.   (See page 414, March issue.)

DISCUSSION

DR. ALEXANDER M. CAMPBELL, GRAND RAPIDS, MICH.—A few years ago we looked up in our clinic the statistics, to determine the frequency of tubal obstruction in sterility. These figures were somewhat controversial in nature and they varied from 25 to 70 per cent. Douay states that indisputable permeability occurs in about 25 per cent of all cases of sterility.

I am pleased that Dr. Newell has suggested his ingenious idea of tubal insufflation following reparative tubal surgery because it attracts attention to the

possibility of reconstructive surgery of the tube. I believe that we are on the threshold of some very definite achievement in the way of restoring fertility to a number of women whose fallopian tubes are impermeable and who are because of it, hopeless cases.

Dr. Newell's suggestion of the employment of a delicate technic in doing tubal surgery is most timely and I believe that gynecologists within the near future will with the development of a proper technic and with proper study of their sterility cases be able by reparative surgery to restore a considerable number of otherwise hopeless cases to a state of fertility.

DR. A. J. RONGY, NEW YORK CITY.—I should like to know the number of cases of tubal obstruction operated upon and the results of these cases two or three years later. Some of us in New York feel that plastic surgery on the fallopian tubes to cure sterility is becoming a bit useless and is gradually given up. In the best of hands there is a 10 per cent cure. If this is true, then a very serious question arises. Given 100 women, subjected to operations for the reconstruction of the closed fallopian tubes, the result will be as follows: 10 per cent may be cured, 90 per cent will have permanent closure of the tube, with no chance whatsoever of the tubes ever becoming patent. If these women were let alone, the chances are that in a great percentage of these patients spontaneous regeneration of the fallopian tube would take place and they would become patent. Spontaneous regeneration of a fallopian tube seldom takes place after plastic surgery has been performed on the tube.

DR. W. A. COVENTRY, DULUTH, MINN.—I think it is very important that a second picture be taken from one to twelve hours after the first picture in order to determine whether the lipiodol which has accumulated in the fimbriated end of the tube leaks through the tube and therefore causes the so-called splash in the pelvic picture. In my opinion, it is very hard at times to determine whether the tubes are really closed at the fimbriated end or whether just the lipiodol is retained in the fimbriated end when the first picture is being taken. The second picture will, as a general rule, confirm the diagnosis.

DR. NEWELL (closing).—In regard to Dr. Schmitz's remarks about the second hysterosalpingogram three months later, I think his suggestion is an excellent one. My routine has been to make a hysterosalpingogram before operation in order to locate the tubal obstruction and fourteen days after the operation for the relief of the obstruction, I make a second hysterosalpingogram, then follow my treatment with gas insufflation tests from time to time in order that the tubes will remain patent.

Recently, I have had the good luck of examining the fallopian tubes when the abdomen was opened in two patients on whom I had performed plastic work for tubal obstruction and found the tubes in both cases patent and in good condition.

Some one suggested taking a second picture twenty-four hours after the first one. Occasionally I do this, but only in cases where the interpretation is not clear. I do not see any particular reason for doing it routinely.

Matin Sleep, by DR. GEORGE F. CHANDLER, Kingston, N. Y. (See page 285, February issue.)

DISCUSSION

DR. E. M. STANTON, SCHENECTADY, N. Y.—I suppose that practically everyone who has listened to this paper and has not himself used the method described by Dr. Chandler has had more or less skepticism. Early in the spring when

Dr. Chandler told me what he was doing, I went down to see a few of his patients. I went in a skeptical frame of mind, but when I got home I began using it in a few cases and then more frequently, until it has gradually become practically a routine procedure with me. We give ten grains of luminal at 9 P.M. the night before operation. I use ethylene in the place of nitrous oxide. It has had a very marked effect on the number of spinal anesthetics that we give. I like to use spinal anesthesia but I feel that there is a great deal more mental hazard for the patient under spinal than under an inhalation anesthesia. With the luminal, it is much easier to give ethylene or ether and I am not using nearly as much spinal anesthesia as I did six or eight months ago.

DR. CHAS. GORDON HEYD, NEW YORK CITY.—In the consideration of anesthesia, and Dr. Chandler's presentation of matin sleep, we are apt to forget that surgical anesthesia embraces two separate and distinct features. There is first the phase of analgesia in which the pain sense is obliterated, and secondly, the phase of narcosis. It is not necessary to have narcosis in order to have analgesia, nor does narcosis imply an analgesia. In local anesthesia the pain sense is obliterated yet the mind is perfectly clear and capable of being traumatized in direct proportion to the stimuli that reach the brain. Dr. Chandler's contribution is of distinct value because it brings to surgical analgesia a therapeutic procedure that is capable of putting the brain to sleep and thereby protecting the patient against the sum total of all stimuli that reach the brain.

We have utilized at the New York Post-Graduate Medical School and Hospital a variety of preoperative narcotics: allonal, luminal, amytal, and sodium amytal both orally and intravenously. We have used the preoperative narcotic for practically every type of anesthesia, local inhalation, intravenous, and rectal. We are firmly convinced that the placing of a patient about to undergo a surgical operation in a semi-narcotic condition before the administration of the anesthesia protects that patient in many ways and that the postoperative convalescence is easier and smoother than for patients who have not been so treated.

In regard to Dr. Wetherell's remarks about spinal anesthesia, we are convinced that there are some patients who do not take spinal anesthesia well. The anesthetic agent is delivered into the spinal canal yet these patients exhibit such a high degree of mental irritability that pressure anywhere in the area of the field of operation is misinterpreted as pain and the anesthetic course of the case is not successful.

DR. ARTHUR H. BILL, CLEVELAND, OHIO.—We have been following a similar principle in obstetric cases. One of the problems, especially in a multipara, is that of a continuous relief of nervousness and of pain. Where administrations of an analgesic are given with the labor pains, there is such an interrupted performance that the patient is more or less conscious between pains, has a fear of going under the anesthetic and is somewhat conscious of the labor. We have been using for some time a method similar to Doctor Chandler's. It just happens that the preparation we have been using is amytal. At the present time this is our routine with multiparae. At the very onset of labor, the multipara is given from 7½ to 10 grains of amytal. This quiets her but does not entirely control the pains. However, it makes it possible when the pains are harder, to relieve the suffering entirely and have a period of somnolence between the pains, so that there is a continuous analgesia enabling the patient to go through all stages of labor and at the end of the labor have practically no consciousness of the entire proceedings. I said that we do this routinely only with the multipara because we still cling to the morphine and scopolamine method in the primipara, and find it most satisfactory.

DR. A. M. MENDENHALL, INDIANAPOLIS, IND.—In Indiana we are using sodium amytal, very much as Dr. Chandler has recommended using luminal. Practically all the general surgeons are now giving sodium amytal in a 3 grain dose the night before operation, and in the morning one or two hours before the operation they are giving 6 grains of sodium amytal. It very satisfactorily prepares the patient for a general anesthesia later.

DR. JAMES E. KING, BUFFALO, N. Y.—Those of us who are confining our surgery largely to women have two distinct anesthetic problems to consider. The first is the choice of anesthetic which will make it possible to conduct our operation satisfactorily; the second, an anesthesia that minimizes the preoperative mental reaction. I have been through the stage of spinal anesthesia and have rejected it, except in certain cases. I have never had the faculty of talking my patients into a quiet state of mind or continuing the conversation during the operation as many men who use spinal anesthesia are able to do. I have been on the lookout for some satisfactory method by which the patient would have less fear preceding and less disturbance after the operation. Recently I have taken up avertin. We have, at the General Hospital, done nearly 500 cases with this drug and, personally, I am convinced that it has great possibilities. In my own series I have only had about 150 cases, which embrace most of the operations in gynecology. It has been extremely satisfactory, not only from the operative side but especially because of the pleasant remarks that the patients make in regard to their experience.

DR. W. W. BABCOCK, PHILADELPHIA, PA.—Dr. Chandler has emphasized the synergistic action of luminal when used as an adjuvant to other anesthetics. Used alone for the production of anesthesia the barbiturates produce such prolonged periods of coma that the patient is very prone to develop secondary bronchial pneumonia, hypostatic congestion, and an increased tendency to thrombosis. In The Mayo Clinic where these drugs, and especially sodium amytal, have been used quite extensively during the last few years in an experimental and clinical way these complications have necessitated postoperative massage and frequent change in the patient's position. It is evident that the barbiturates should not be used as pure anesthetics.

To many hypnotic drugs the young patient reacts with delirium, the elderly and toxic patient with coma. Thus from amytal or luminal one patient becomes widely delirious, another stuporous. The liver is the great detoxicating organ of the body. If it functions badly as in old age then the physiologic effect is modified. It is evident that these drugs should be used with care in the senile, septic, or toxic patient. As Dr. Chandler has mentioned, we should use these drugs only as adjuvants to aid in the production of anesthesia. Doses sufficient to cause prolonged stupor should be avoided. I take it that Dr. Chandler reduces the large doses mentioned for the substandard patient. Obviously intravenous anesthesia has not yet been rendered safe and I am glad that Dr. Chandler does not recommend it.

DR. CHANDLER, (closing).—In reply to the question about morphine and scopolamine or atropine, I do not give these drugs at all, just the luminal.

I have used sodium amytal, intravenously and by mouth, and had an unfortunate fatal result with it intravenously.

The Sedimentation Rate in Gynecology and Obstetrics. Results of Three Thousand Tests on One Thousand Patients by Recent Modification of Westergren's Method, by DR. ALBERT MATHIEU, Portland, Oregon. (See page 197, February issue.)

DISCUSSION

DR. F. H. FALLS, CHICAGO, ILL.—From a study of this apparatus I think it commends itself first because of its simplicity and convenience, secondly because one is able to begin readings and complete them in forty-five minutes. It is also valuable because the tubes are of a type that can easily be cleaned.

As to the value of the sedimentation test, I think Dr. Mathieu has pointed out certain things that are of great importance; in the first place, the observation that there was an increase in sedimentation time in retention of membranes without infection. Naturally this limits its value for a clinician who is looking for evidence of infection. In differential diagnosis of carcinoma of the cervix and simple erosion of the cervix it would be very simple if this test showed an increased sedimentation rate in carcinoma of the cervix and not in erosion. We have tried to stress that point in our investigations, but we found that minor pathologic conditions will increase the rate just as much as a carcinoma will. A tonsillitis or a chronic tubercular ulcer will increase the rate. Therefore, in the case of differential diagnosis between simple erosion of the cervix and carcinoma of the cervix, one would have to be very careful that there was not some other factor that would increase the sedimentation rate so that it might be interpreted as carcinoma.

In our series of cases we have noticed an increase in the sedimentation rate does not occur early in postoperative complications. That is, there may be a delay in the appearance of the increased sedimentation rate after the clinical evidence of the peritonitis, or other postoperative complications, has been present for several days. In other words, there may be a delayed reaction. Manifestly in this case, it would be of no clinical value.

DR. W. E. DARNALL, ATLANTIC CITY, N. J.—I confess that when this sedimentation test was first brought out I was somewhat skeptical about it, but in the last two or three years, in our gynecologic work particularly, we have been making a sedimentation test routinely and I think the more we study it the more we realize its importance.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—We have done some 6000 tests by the Friedlander method. We have tried to keep this test out of the laboratory and have taught our students and residents to do it, believing it to be of more value when associated with the clinical story, just as we do with the blood and urine than it is to allow it to be distinctly a laboratory procedure. It is not diagnostic, but when it is correlated with the story of disease and the picture of disease it is a very helpful diagnostic method to determine the presence or absence of infection.

Dr. Falls did not bring out clearly to my mind one point. Dr. Mathieu noted that the sedimentation time was more rapid in cases of retained membrane even when there was no infection present. This is a very important thing to remember because we use this test to determine when to empty the uterus of retained material and unless the sedimentation time becomes longer and longer the woman has not protected herself against the infection and until protection is established on the part of the patient we do not want to increase her danger by opening up the sinuses of the uterus by curettage.

DR. H. W. YATES, DETROIT, MICH.—In our series of cases, about 1550, we have used the ordinary early type of the Friedlander technic. We found that when we left this in the hands of our interns it was very likely to be faulty, and was never dependable. We used it in about 80 cases at first and found variations in the leucocyte count and the operative findings so that we could not depend upon it. After reading papers recommending it we again used it on 150 patients and

were again disappointed. I could not help but feel that there was something wrong with the technic, therefore we had these tests done entirely in the laboratory, under the strict supervision of a technician, and then we began to find that we had some definite results.

We have found in our series of cases, carrying out the impression of the essayist, that it is very much more dependable than the blood count. When we have found in many instances that the clinical findings are those of normalcy and the leucocyte count likewise normal, we have operated in spite of the sedimentation test showing an infection and in those cases we found we should have gone according to the sedimentation test rather than the clinical and blood findings.

DR. L. A. CALKINS, KANSAS CITY, KAN.—We have been using the sedimentation test routinely for four years and have not operated upon any salpingitis case until the sedimentation time was less than 20 mm. in one hour. We believe that we could use a fifteen-minute test with just as great advantage as the one-hour test. We should not, however, forget that the sedimentation test is not reliable in anemic patients. The greater the anemia the greater the degree of sedimentation from the anemia alone, so that in those patients we must correct for the anemia.

I would like to repeat again that this test is not of any value in a differential diagnosis. It does, in a measure, indicate the presence of infection but its real value is in determining the time of operability, and we believe it is worth more than temperature, pulse, white count, and the Simpson test all combined.

DR. MATHIEU (closing).—To me the important points in the paper are the facts that one blood specimen is sufficient for all the blood studies; and that the technic described is perfectly reliable for sedimentation distance readings.

As to the cause of the sedimentation phenomenon, the work done to date would lead us to believe that in the presence of infection or inflammation, there is a marked increase of the fibrinogen content of the blood plasma, and we think that this fibrinogen is poured out by the liver. At any rate it has been proved by Weiner of New York that there is a marked increase of the fibrinogen content of the blood plasma in infection and inflammation.

These points all lead us to wonder why the pregnant woman shows such a marked continuous increase in the sedimentation distance of her blood. This takes place practically as an arithmetical progression. My opinion is that as the pregnancy increases in time so does the size of the placenta increase; so do as a rule, the number of infarcts increase and so does also the probable infection of the placenta and so do also the number of syncitial buds that may gain access to the maternal circulation.

Postoperative Abdominal Fistula, by DR. J. F. ERDMANN, New York City. (Will be published in the current volume of Transactions.)

Choriomas—A Clinical and Pathologic Study, by DR. HENRY SCHMITZ, Chicago, Ill. (See page 256, February issue.)

DISCUSSION

DR. JOHN O. POLAK, BROOKLYN, N. Y.—Dr. Schmitz's classification is a little further advanced than the one Ewing brought out many years ago and which has been the standard classification in this country from that time on.

The surprising thing about this condition is the statement in almost every textbook as to the incidence of the occurrence following hydatidiform mole. The cases of chorionepithelioma which we have seen have all followed a full-time pregnancy or premature labor. We have never seen a case of chorionepithelioma follow

a hydatidiform mole. A recent check-up of our hydatidiform mole cases disclosed between 40 and 50 in the last ten years. Incidentally, we have a 92 per cent follow-up in our clinic. We instruct every woman that if any bleeding occurs after discharge from the hospital she must report back. The result is that we find this bleeding is usually due to misplacements or a subinvolution and if corrected, with a pessary or with the use of ergot, quinine and strychnia, the bleeding is promptly stopped. The incidence, therefore, of hydatidiform mole being followed has been nil so far as chorionepithelioma is concerned. We have at the same time seen ten of these cases occur as the result of a previous pregnancy and delivery, some in very young women. There were two in which the first evidence was shown in an attack of pleurisy without any history of bleeding whatsoever and on tapping the chest made a diagnosis from the cells that were found. Ordinarily these people present a story that is rather consistent; they persistently bleed, yet their pallor is out of proportion to the blood loss. It is a cachexia and skin appearance that is out of proportion to their actual blood loss; the cervix is almost invariably open.

One other very interesting case was diagnosed as an ectopic. The chorionepithelioma had passed through the uterine wall and the patient had an intraabdominal hemorrhage which simulated the picture of ectopic with the attack of pain and anemia.

DR. JAMES E. DAVIS, ANN ARBOR, MICH.—One should not depend upon a diagnosis that is rendered from a very small or scant specimen obtained by curetting the uterus, as no pathologist can offer a diagnosis of any value. To secure biopsy material that is worth while, the curettage must be thoroughly done to secure a specimen from the area suspected and which will extend beneath the epithelial layer. In other words, it is exceedingly important that the microscopic material shall include enough tissue so that the area examined will display both normal and involved tissues. A comparison of the involved and uninvolved areas is of great value.

It is necessary to consider trophoplastic tissue in relation to its problem of differentiation. What is the ultimate outcome of its differentiation? Normally it is essentially just trophic material. A hypertrophic change may be due to an increased blood supply or to irritation, which of course brings about an increased blood supply. This change should not mislead one and be regarded as malignant. The malignant trophic change means that the cells have become differentiated in such a way physiologically and anatomically that there is a change from the normal. Anatomically the cells have become unlimited and grow beyond the basement membrane or the area they should occupy during existence as normally functioning cells. The latter are not out of control of their cellular laws.

The atrophic type of change in trophoplastic tissues is frequently spectacular. When metastasis has become widely disseminated, deactivation of the trophoblastic tissue may suddenly occur, and atrophy follows. It is well known that this occurs simultaneously or directly after the uterus has been emptied. What is the deactivating substance produced, and how does it produce a reversal of the growth? Has this low grade germ plasm been deprived of an optimum condition for its development, and was this resident in the uterus as a parasitic hormone which when reduced in quantity reached impotency? Its action appears different from Fleming's lysozyme.

DR. ALBERT MATHIEU, PORTLAND, OREGON.—We found in 150 Aschheim-Zondek tests that for several days following pregnancy or miscarriage this test was still positive, although we have seen no cases of hydatidiform mole or choriomas since we started this work. I would like to know what Dr. Schmitz's experience has been. We feel that in a case of chorionepithelioma the reaction should be positive

and that in hydatidiform mole there would be a similar reaction. In fact it has been shown that the reactions in cases of chorionepithelioma and hydatidiform are so strong that a positive reaction can be gotten by using one-tenth of the amount of urine that one would ordinarily use and that on the strength of a positive test with this dilution diagnosis of chorionepithelioma or hydatidiform can be made.

DR. SCHMITZ (closing).—Fortunately all of these cases were operated upon after the microscopic examination of tissues removed from the uteri. One of the cases treated with radiations had an enormous extension of the chorionepithelioma into the vagina and an excision was made for diagnosis. In the other case treated with radiations the entire ovum and tumor were expelled and thus microscopic diagnosis could be made.

The diagnosis of choriomas offers many difficulties and errors in diagnosis are frequent. This is the reason for the division of the clinical varieties into benign and malignant, stating the histologic characteristics for each group in an early, comprehensive and simple manner, and basing the indications for treatment on this classification: namely, the benign choriomas are self-limited, usually detach themselves completely from the maternal tissue and are expelled in toto. Should hemorrhages recur, then curettage must be done. The malignant choriomas indicate hysterectomy, even if metastases have formed.

Applying radiations after operation to prevent recurrences or to kill vestiges of tumor tissue that may have been left behind or may have been spilled during operation will improve the percentage of good end-results.

We had three cases of placental moles, two simple and one invasive. They were accompanied by the most profuse hemorrhages we have ever observd. One woman was thirty-five years of age. She had been discharged from the hospital three times with the diagnosis of pregnancy. She returned to the follow-up clinic while bleeding. A vaginal hysterectomy was done and a placental mole was found. One other patient was forty-eight years old. A diagnosis of carcinoma of the body was made. Vaginal hysterectomy was done. Microscopic examination revealed a placental mole. It shows how very careful one should be in making diagnosis without corroboration by microscopic examination. These three patients would have been saved from hysterectomy had a frozen section diagnosis been made before operation. Unfortunately the hospital did not have these facilities and one was compelled to rely on the clinical evidence which justified the procedure.

Abstract of discussion of Dr. Jones's paper on Cancer of the Cervix.
(For discussion, see page 187, February issue.)

DR. WM. SEAMAN BAINBRIDGE, New York City.—While this contribution sheds indeed a hopeful and optimistic light on the action of radium in early cancer of the cervix, the contents of the paper do not bring out the comparison, indicated in the superscription, between the results of surgery and of radiation. A justifiable tendency is often found, on the part of contributors in various fields, to rely on the discussion for bringing out the necessary data on the other side of the line of argumentation. Moreover, many have questioned if an actual, fair, and just comparison is practicable in these circumstances. More or less insuperable difficulties are found here, for in behalf of surgery, it is imperative to take into consideration the operability of the patients, the stage of the disease, the time of the intervention, the condition of the pelvic glands, the immediate or operative mortality, the length of survival rates, the results some years after treatment, etc. The gathering of comparative data from the literature provides no feast, but a

veritable famine of figures on which a truthful and instructive comparison can be based. The whole subject at the present time is still, as it were, in chaos.

My own experience inclines me as yet in favor of surgery in operable cases, with or without some form of heat: and from this viewpoint I shall endeavor to supplement the information conveyed in the Cleveland paper. It is noteworthy that even a convinced adherent of radium, like Dannreuther, concedes that in spite of encouraging statistics from the Radium Institutes in London, Paris, and Stockholm, many Continental gynecologists are still enthusiastic advocates of radical abdominal hysterectomy. Weibel in Prague, Warnekros in Dresden, Faure in Paris, and Bonney in London, have done a very large number of these operations, and each one claims a primary mortality of less than 8 per cent, with a very satisfactory number of five-year cures.

DR. HENRY SCHMITZ, Chicago, Ill.—If the results of radiation therapy are the same as those of surgery in the clearly operable cases, i.e., the incipient nodular stage, then one must agree that both methods of treatment are standard. Statistics of good end-results of treatment show conclusively that radiation therapy gives equally good results as surgery in cervical carcinomas. The former has the advantage of a negligible mortality and morbidity after treatment in comparison to those of surgery.

The question then simmers down to the cases that are inoperable. The unfortunate women who are beyond surgical help may be treated with irradiation and the results in some of these cases are certainly amazing. The inoperable group may give from 10 to 15 per cent five-year good end-results. Surgery could not have benefited such patients at all.

We should educate every physician and every surgeon and every medical student who is not familiar with cancer to diagnose this condition early and then to determine what method of treatment must be used. When we have done that the control of cancer will be attained.

DR. S. E. TRACY, Philadelphia, Pa.—Dr. Jones stated that cases of carcinoma of the uterus do not come any earlier than they did twenty years ago. That statement corresponds with our observations. At the American Oncologic Hospital this year there have been about thirty cases of carcinoma of the uterus and only one was early.

We have a few cases of cancer of the cervix treated by radical operation which are alive more than ten years; however, when we consider the morbidity and the high primary mortality of the radical operation there is no doubt that the end-results from treatment by radium will be better than from surgery. We have some cases treated with radium and deep x-ray therapy, in fact, almost all our cases are given deep x-ray therapy after the radium, who are alive and perfectly well over five years.

DR. JONES (closing).—Out of the entire group of cases we refused only 11 cases, so that we treated 97 per cent of our series, and this is twice as much as anybody can possibly do, I think, by operation. The average operability is about 50 per cent. We were justified in not recommending treatment in these 11 cases for the patients only lived six weeks after leaving the clinic. To try to treat those patients brings disrepute upon a perfectly good therapeutic agent.

Tumor of the Fundus of the Uterus, by Dr. J. W. Kennedy, Philadelphia, Pa. (Will appear in the current volume of Transactions.)

Spontaneous Rupture of the Esophagus Following Vomiting, by Dr. Lewis F. Smead, Toledo, Ohio. (Will appear in the current volume of Transactions.)

The Cervical Cesarean Section. A Report on the End-Results of 418 Consecutive Operations, by Dr. L. E. Phaneuf, Boston, Mass. (See page 498.)

ABSTRACT OF DISCUSSION

DR. W. W. BABCOCK, Philadelphia, Pa.—The thing that stands out in the paper is that by doing this low type of operation the danger of rupture of the uterus during a succeeding pregnancy is largely eliminated. This is most important as one is shocked at the number of ruptured uteri secondary to cesarean section that have been reported. Apparently this is an operation, however, that requires a skilled operator. Evidently great harm might be done if the operator were clumsy. I take it that the low operation renders it rather more difficult to extract the child, which in forcible and unskilled hands might suffer injury. Apparently this type of operation takes a little more time.

The anesthetic Dr. Phaneuf has employed interested me. As to local anesthesia, which he has used successfully, much more may be given than is generally appreciated. My maximum in using local anesthesia is a pint of a 1 per cent or a quart of a ½ per cent solution. Deaths from procaine almost invariably occur from small doses of a relatively strong solution. Large quantities of dilute solution have rarely caused death. In operating within the abdomen, one can flood the retroperitoneal spaces and the tissues in the pelvis very freely without detriment to the patient. Indeed, patients in shock or early collapse often improve under free infiltration of weak procaine, adrenalin solution.

THE NEW YORK OBSTETRICAL SOCIETY

MEETING OF NOVEMBER 11, 1930

Dr. Orville H. Schell (by invitation) reported a **Case of Persistent Uterine Contraction Ring.** (To be published in a later issue of the Journal.)

Dr. F. W. Sovak read a paper on **Hemangio-Endothelioma Intravasculare of the Ovary.** (For original article see page 544.)

DISCUSSION

DR. W. S. STONE.—The scientific interest in this case is largely in the interpretation of its histologic structure. The term, endothelioma, as applied to an ovarian tumor usually indicates a complex histology. In a study which I made some years ago of the so-called Krukenberg tumor, I found that many of them, especially in the German literature, were called endothelioma, most of which were undoubtedly secondary to tumors of the gastrointestinal tract. Clinically, they cannot be distinguished and their malignant qualities may vary.

DR. F. W. SOVAK.—What Dr. Stone says is true. A great many of these tumors have been of the Krukenberg type; that is, malignant tumors have been classified as endothelioma. In the review of the literature I omitted to state that that is brought out very nicely. Also a lot of the endotheliomas are of the perivascular type, or those arising from the lymph vessels. This is a special type of tumor which forms walls or linings of luminae which are filled with red blood cells.

DR. CHARLES E. CAVERLY (by invitation) read a paper entitled **Ovarian Cysts Complicating Pregnancy.** (For original article see page 566.)

DISCUSSION

DR. CHARLES A. GORDON.—It is certainly hard to standardize and of course not even advisable to try to standardize treatment in any way because so much depends upon the size of the cyst, its location, its character, if that can be determined, and the status of the woman, as to whether she is a primipara, an old primipara, very anxious for a baby, or a multipara with a history of repeated easy labors.

If I were to crystallize my thoughts in the matter I would say that no operation should be done before the third month, and not even then unless necessary for some reason or other; that the patient should be carried to as near term as possible; and that delivery should be effected by cesarean section with removal of the cyst after the closing of the wound in the uterus. If labor is spontaneous, either by accident or design, operation should be done in the puerperium for any untoward symptom which the patient presents. Operation should be done before she leaves the hospital anyway, if possible, and the patient should be warned of the seriousness of the condition in the event of another pregnancy.

Dermoid is not at all uncommon and the tragic consequences of dermoid rupture should be borne in mind.

DR. ONSLOW A. GORDON, JR.—While we may draw different conclusions from the same set of figures, it would seem to me from the figures presented by Dr. Caverly that it is more logical to conclude, not as Dr. Charles Gordon did, that the time to operate upon these cysts is some time after the third month, but as soon as discovered to remove them, and then permit the woman to have a normal labor. That seems to me to be far more preferable because then you have a woman who is not liable to the complications subsequently and to cesarean section in subsequent pregnancies.

DR. B. P. WATSON.—One of the interesting things which has been brought out in this paper is the comparative harmlessness of the dermoid today as contrasted with what it was, say, fifteen or twenty years ago. We were taught that the dermoid was the tumor which was most likely to cause complications during pregnancy and especially during labor. The reason was that it was a tumor of the pelvis and obstructed labor. Nowadays we discover these tumors earlier in pregnancy and remove them, hence, we do not get the number of obstructed labors from pelvic tumors that we formerly got. That is very well brought out in Dr. Caverly's statistics as compared with those of McKerron, which were compiled in 1903. I feel that if the tumor is not discovered until late in pregnancy it is much better, providing it is not obstructing the pelvis, to allow normal labor to go on and then do an ovariotomy in the puerperium rather than do ovariotomy plus cesarean section which might prejudice the patient's future pregnancies and future labors.

DR. CHARLES E. CAVERLY.—Dr. Gordon mentioned a particular case of a very large cyst which was diagnosed, I believe, only after labor. Several such cases were seen among the 83 cases which I collected where the abdominal distention, unexplained and undiagnosed during pregnancy, was determined to be due to an ovarian cyst only after labor, when the small, hard uterus could be felt definitely separate from the soft, flaccid tumor mass above.

I agree with Dr. Gordon that ovariotomy should be postponed if possible until after completion of the third month of pregnancy because that is the period of greatest danger of abortion from whatever cause. I do not think that it is in line with my findings to defer operation until full term because to do so is to ignore

the risk of symptoms caused by the tumor and that of complications which may occur in the tumor. As Dr. Gordon says, if a cyst is first diagnosed near the end of pregnancy, if the patient can be kept under observation, and if labor and delivery promise to be not unduly complicated, then it is better to await full term and possible spontaneous delivery, rather than to do a cesarean section, because thereby can be avoided an incision in the uterus which might necessitate subsequent section with other pregnancies.

Dr. Watson says that labor obstructed by a dermoid cyst in the pelvis is seldom seen now, although formerly not uncommon. That is due, I think, to the more thorough antepartum examination and treatment, certainly in an obstetric hospital practice, of the present day as compared with former times.

Dr. James A. Corscaden read a paper entitled **The Late Anatomic Effect of the Radiotherapeutic Menopause.** (To be published in a later issue of the Journal.)

NEW YORK OBSTETRICAL SOCIETY

MEETING OF DECEMBER 9, 1930

Dr. C. E. Galloway, Evanston, Ill., presented (invitation) a paper entitled **Postpartum Care.** (For original article see page 558.)

ABSTRACT OF DISCUSSION

DR. WILBUR WARD.—What struck me as the most practical point was the care in the intermediate stage. I do not believe a woman can go through pregnancy and labor, get into a chair on the sixth day, be on her feet on the seventh day, go home on the twelfth day and resume her normal activities at once, take care of the baby, herself, her family, and household. Dr. Galloway's method in his own locality of having some one representing him go out to the homes of patients when they are not able or qualified to look after themselves and tell them how to do things to relieve the burden is subject to modifications in the various localities, but it is a mighty good idea.

DR. O. PAUL HUMPSTONE.—I wonder if the exercise that the doctor advises after labor is not begun too soon. The careful observation of whether there is any subinvolution which might cause an embolus is not always carried out in a hospital, and the woman is routinely told to take the knee-chest exercise beginning the twelfth day. I might report that we have had two cases of embolus following this and now we do not begin any postpartum exercise until the fourth week when the patient begins with her knee-chest exercises and two weeks later begins her abdominal exercise.

DR. E. C. LYON, JR.—Our custom has been to watch the patient carefully during pregnancy for anemia and with certain low percentages of hemoglobin and red blood cells to always have the donor ready outside the delivery room, and in that way we feel we accomplish a good deal in avoiding postpartum bleeding which might otherwise become serious.

SYMPOSIUM ON RESUSCITATION OF THE NEWBORN

Dr. Douglas Murphy (by invitation) described the **Drinker Respirator Treatment of the Immediate Asphyxia of the Newborn.** (For original article see page 528.)

DR. POL N. CORYLLOS read a paper (by invitation) entitled **Atelectasis, Asphyxia and Resuscitation in the Newborn.** (For original article see page 512.)

DR. P. J. FLAGG submitted a paper (by invitation) on **The Treatment of Postnatal Asphyxia.** (For original article see page 537.)

DR. YANDELL HENDERSON presented a paper (by invitation) on **The Inhalational Method of Resuscitation from Asphyxia of the Newborn.** (For original article see page 542.)

DR. B. CROTHERS presented **The Mechanism of Labor From the Viewpoint of the Neurologist.** (For original article see page 526.)

DR. GEORGE W. KOSMAK presented the **Viewpoint of the Obstetrician in Asphyxia Neonatorum,** as follows:

The obstetric point of view with regard to asphyxia neonatorum may be somewhat different from that of the physiologist, the neurologist, the pathologist, and other groups of workers who have interested themselves in the problem. Asphyxia of the newborn is a complication of pregnancy and labor that the obstetrician must always fear and be prepared to meet the emergency. Methods of resuscitation have been largely modified in recent years and many varieties of mechanical apparatus have been introduced which show, I assume, the imperfections of such procedures. Moreover, they are usually costly, delicate in their mechanism, and should only be operated by a person well qualified to do so.

It seems to me that the obstetrician should be prepared to anticipate the need for resuscitation measures by timely recognition of the factors which produce the condition. From this particular point of view I believe it is possible to divide cases of asphyxia neonatorum into several groups as follows:

1. Where asphyxia has occurred before delivery, due to interference with the circulation through the cord by knots, pressure or prolapse, placental separation, ruptured velamentous cord, low placental insertion, tetany of the uterus, and narcosis, analgesia or anesthesia of the mother.

2. Where asphyxia occurs during labor, as from prolonged pressure on the head in the birth canal, during the process of version, instrumental delivery, premature inspiratory efforts.

3. Where asphyxia occurs after labor or from injury to the cerebral vessels due to sudden compression or release of the head as it passes through the pelvic canal, from injuries to the cord or head in the process of version and from forcible efforts at resuscitation aggravating the condition by the production of injuries.

4. Prematurity, in which as the result of defective development the respiratory mechanism is unable to function.

5. Asphyxia from analgesia of the mother.

Clinically the recognition of asphyxia before labor can only be determined by the alteration in the fetal heart sounds, or in vertex presentations by the passage of meconium. The so-called intrauterine cry has also been assumed to be an indication of trouble but this is a rather doubtful sign.

Asphyxia coming on at varying periods after delivery has been attributed to atelectasis and this in turn has been accepted for a basis for pneumonia. Experimental evidence seems to confirm the latter; at the same time, fairly conclusive

evidence has been brought forward by the Sloane group that a large number of neonatal pneumonia cases are due to the inspiration of liquor amnii and other materials. I also believe that other foreign bodies may be inspired such as the fuzz from blankets, and there is no doubt that in crowded nurseries pneumonia of an infectious type may occur. However, this is somewhat outside the province of this symposium.

The treatment of asphyxia by the obstetrician must depend on the facilities at hand. The various devices which have been developed for the treatment of asphyxia in the newborn are of undoubted value but the attendant is usually forced to rely on simpler methods. Removal of mucus from the mouth or the trachea, keeping the baby quiet and warm, careful compression and relaxation of the chest, together with massage of the heart in some cases, mouth to mouth insufflation, and the use of hot and cold tubs offer the safest means for making the baby breathe. Personally I have discarded slapping, the various swinging maneuvers, or holding a deeply asphyxiated baby with the head downward as provocative of injuries that may contribute to make a previous asphyxia a permanent one and result in the loss of the baby. Where obtainable, the careful administration of carbon dioxide mixtures as advocated by Dr. Henderson, is strikingly important from the results obtained and this procedure is worthy of increased attention.

ABSTRACT OF DISCUSSION

DR. RICHARD N. PIERSON.—Dr. Crothers commented on the surprising fact that in all the evening's discussion on asphyxia in the newborn, no mention was made of the physiology of labor and its effect upon the child. If we are to prevent asphyxia in the newborn, we, as obstetricians, must concentrate on the physiology of labor and realize that every deviation from the normal will have its effect upon the child. It is well to remember the influence of all sedative, analgesic, and anesthetic drugs in causing asphyxia in the baby. I believe that anyone who has used carbon dioxide and oxygen for the resuscitation of the newborn will agree with Dr. Henderson that it is wonderfully affective and should always be available. The simple methods of administration seem to me effective. I am not convinced that the elaborate apparatus of Drinker or that of Flagg is needed.

DR. J. M. MABBOTT.—It occurs to me to inquire whether other mixtures have been employed rather than oxygen and carbon dioxide only. Further, in view of the fact that the baby is expected to breathe air which is only 20 per cent oxygen, if I remember, and 80 per cent of other things, mostly nitrogen, the suggestion might be advanced that possibly some other mixture could be used requiring less carbon dioxide to stimulate the medulla and cause deep respiration. I would like to know whether mixtures including nitrogen and oxygen have been used.

DR. P. N. CORYLLOS.—I was greatly impressed by the statistics presented by Dr. Henderson, and the great number of newborn lost every year, either from acute asphyxia or from subsequent respiratory complications due to persistence of bronchial obstruction and of partial atelectasis. We all agree that extrauterine life is not possible without adequate respiratory gas exchanges in the lungs which insure adequate oxygenation of the blood, elimination of CO_2 and regulation of the acid-base equilibrium, indispensable for the normal function of the respiratory center.

Therefore the first and most important indication in asphyxia of a newborn is to eliminate any mechanical obstruction not only of the larynx but of the trachea and the bronchial tree itself. The method advised by Dr. Flagg seems to me the most adequate for that purpose. There is no doubt in my mind that patency of the tracheobronchial tree is the most important factor in resuscitation in gen-

·eral and more particularly in the newborn, in which conditions are less favorable because of the presence of atelectasis and the absence of negative intrapleural pressure. It seems very peculiar that so little attention has been given so far to this important factor; we try by indirect methods to clear the bronchi when it is so simple to do it by direct laryngoscopy, so easy a procedure in the asphyxiated newborn that not only every anesthetist but also every obstetrician and medical man should be able to use it. Furthermore, insufflations of CO_2 and O_2 by the same way accomplish far more than any other method by actively dilating the atelectatic lung and consequently increasing the circulation in this organ and in this way bringing the respiratory gases into the blood.

Dr. Henderson has insisted with reason upon the danger of subsequent infectious complications in persistent obstructive atelectasis. I am most gratified that he admitted the relation of the latter to pneumonia and bronchopneumonia of the newborn, and that he pointed out the similarities of these complications, to postoperative atelectasis, pneumonia, and bronchopneumonia. What I cannot understand, however, is that he hesitates to introduce medical lobar pneumonia into the same group, although he has admitted not only the pathologic and bacteriologic identity of it with postatlectatic pneumonia as well in the newborn and in postoperative pneumonia, but, also strongly advises the same treatment in all three of them, namely O_2–CO_2 inhalation.

As for the Drinker apparatus, so ably presented by Dr. Murphy, I have a few objections. I think that this method, which is familiar to me, because I used extensively a very similar apparatus described as "oscillating vacuum box" in my experimental work with Dr. Birnbaum since 1925, simply replaces the manual artificial respiration by a mechanical and more physiologic method of artificial and rhythmic expansion of the thoracic cavity. It neglects, however, the other two very important factors in the establishment of the normal and automatic function of the respiratory center; first the patency of the bronchi, without which no pulmonary expansion is possible, however strongly we expand the thoracic cage, and second the regulation of CO_2 in the circulating blood, without which no regular function of the respiratory center is possible.

I would say a word on traumatic lesions of the respiratory center, so thoroughly presented by Dr. Bronson Crothers. There is no doubt that increased intracranial pressure has a great influence upon the function of this center, notwithstanding its highly developed automatism which allows its separation from the cerebrum and the spinal cord, by sectioning the medulla above and below the striae acusticae without greatly affecting its function. But on the other hand the question could be raised if it is really desirous to save infants with serious intracranial traumatisms, considering all subsequent complications to which they are exposed because of this hemorrhage.

DR. YANDELL HENDERSON.—I was glad to hear Dr. Crothers say that in his judgment as a rule those children who ought not to live because of a neurologic defect do not breathe. Von Reuss states that there is no evidence that a very prolonged labor causes subsequent neurologic defects. That is the German evidence.

Failure to breathe, or poor respiration is often due to intracranial hemorrhage. At the Massachusetts General Hospital, some years ago, Dr. J. C. White, on my advice, administered inhalations of carbon dioxide and air after surgical operations. In three or four cases after brain operations on adults, there was a slow postoperative hemorrhage. Respiration went down from 8 to 6 to 4 to 2 per minute. In all these cases. administration of enough carbon dioxide to overcome the de-

pression of the respiratory center maintained respiration; and the patients lived. There is good reason therefore why the same treatment should be used and the same result expected in intracranial hemorrhage in the newborn.

I wish to assure Dr. Murphy that there is no fundamental disagreement between us. He is working particularly on extreme cases on the borderline of complete stillbirth. I, on the other hand, am trying to direct attention to those babies who are born normal and afterward develop a depression of respiration leading to pneumonia. If a hospital can afford a Drinker apparatus and can save 1 in 1,000 or 1 in 5,000 children, it is a life saved. My efforts are directed rather to a prophylaxis for the very much larger number of children who now develop pneumonia in the first few weeks of life. Such pneumonia is the result of continuing areas of atelectasis. Neonatal pneumonia will be largely eliminated when every child, strong and normal as well as weak or premature, receives an inhalation of carbon dioxide in oxygen. That practice is surely coming. Dilate the lungs in this way and neonatal pneumonia will almost cease to occur. It now kills 4 in each 100 live births.

A question was asked about *gas mixtures*. Many mixtures are used. In the treatment of lobar pneumonia it is advisable to give only 50 or 60 per cent oxygen, for higher concentrations given for a long period of time have an irritant effect on the lungs. Formerly for treating asphyxia we used 5 per cent carbon dioxide, for the reason that this is the normal amount in the lungs, while 7 per cent carbon dioxide gives a normal man a slight headache. Now that the treatment is established, we use 7 per cent, which is a very much stronger stimulant. The ordinary nurse can give it by holding a mask on the child's face.

Dr. Coryllos asserts that all lobar pneumonia begins with bronchial obstruction and produces atelectasis. I hope that is true. But I do not assert it until I know.

DR. DOUGLAS P. MURPHY.—One point has impressed me as I have watched deeply asphyxiated infants, namely, that no artificial stimulus appears to inaugurate respiratory movements. If this is true, the object of treatment should be the maintenance of an adequate supply of oxygen until the respiratory center begins to function automatically and adequately. During this period the infant should be subjected to the least possible amount of trauma or metabolic activity. It is believed that the Drinker respirator fulfills these requirements better than any other method. It would seem to be the most scientific method of maintaining artificial ventilation, in that *it allows no force to be applied to the organism which cannot be both controlled and measured.*

DR. BRONSON CROTHERS.—The *neurologist* believes that a study of handicapped babies and a review of pathologic investigations of babies dying during, or shortly after, birth gives him a right to discuss resuscitation, which he never sees at first hand. From his point of view apnea is explained, in many cases, by lack of excitability of the medulla. If the medulla is not excitable it seems logical to maintain life without it for a while. The Drinker respirator is perfectly adapted to this purpose. If gross injury of vessels exists it seems unreasonable to force blood from the trunk into the head, yet this transfer of blood must occur when vigorous pressure on the trunk is imposed before respiration starts.

As far as I can see neurologic theorizing simply confirms the present practice of gentle and skillful obstetricians.

BROOKLYN GYNECOLOGICAL SOCIETY

MEETING OF OCTOBER 3, 1930

DR. WILLIAM F. NELMS read a paper entitled **A Review of the Treatment of Cases of Placenta Previa at the Brooklyn Hospital for the Past Ten Years.** (For original article see page 550.)

ABSTRACT OF DISCUSSION

DR. JOHN O. POLAK.—We cannot pass over the remarkable records of the treatment of placenta previa by Bill of Cleveland without concluding that cesarean section has a certain definite place. Our own feeling has always been that there are definite factors which determine what we shall do, namely; the condition of the cervix, the parity of the woman, the amount of blood loss, the period of gestation, the condition of the child and of the patient, together with the presence or absence of sepsis. If we could teach the practitioner that by the use of a hypodermic of morphine the uterine contractions will cease and the hemorrhage stop in the majority of instances, and if he would avoid packing, many of the cases that are brought to the hospital would be saved from infection.

I believe that we can do more by the simple rupture of the membranes in the partial and marginal cases, leaving them alone and applying an abdominal binder, than by the use of bags and version. We had considerable experience with bipolar version both at the Jewish and Long Island College Hospitals. In a series of 63 consecutive cases the maternal mortality was only 2 per cent and fetal mortality 53 per cent. A simple bipolar version was done, bringing down a foot and allowing the woman to expel the baby, thus avoiding trauma and rupture into the lower uterine segment.

DR. JOSHUA RONSHEIM.—At the Jewish Hospital of Brooklyn from 1908 to 1929, inclusive, there were 205 cases of placenta previa with a maternal mortality of 12, or 6.3 per cent, for the entire twenty years. We have a great many men at the Jewish Hospital doing obstetrics, and I think of those 205 cases about 40 have come under my personal supervision. In that group I have done two cesarean sections; one of the patients was a primipara with a central placenta previa at full term with a long undilated cervix, and in which vaginal manipulation was out of the question. The second one was done only a couple of years ago in a girl who had a flat pelvis. She had had a previous version and breech extraction done because of unengagement of the head, with a stillbirth and a third degree laceration. In her second pregnancy she came under my care and when she was thirty-five weeks pregnant she suddenly had quite a severe hemorrhage. Examination showed a placenta previa of, I should say, the marginal type. Inasmuch as she had this calamity with her first baby, while I did not think the contraction of her pelvis was sufficient to cause any difficulty with delivery of the aftercoming head, I did think that the placenta previa in combination with the dystocia due to contracted pelvis was sufficient to justify section. We had no maternal mortality in those two; as a matter of fact, up to this time I have never lost a mother from placenta previa.

I believe that 15 to 20 per cent of the patients with placenta previa will deliver spontaneously, after rupture of the membranes. Following that, ignoring for a moment the baby, with two fingers' dilatation, the best procedure without doubt is a Braxton-Hicks version, but the trouble with that is that very few men know how to do it, and by the time they have accomplished it, instead of having

two fingers' dilatation, they have almost complete dilatation from laceration of the cervix. Second, there are a great many men who cannot resist the temptation after they have done a Braxton-Hicks to do an immediate delivery rather than to put the patient back in bed and leave her alone; they want to save the baby and in that way they lacerate the cervix and have postpartum hemorrhage and death.

DR. HARRY W. MAYES.—The treatment of postpartum hemorrhage is practically the same at the Methodist Episcopal Hospital as that which has been outlined by Dr. Nelms for the Brooklyn Hospital. One of the most important factors is an adequate preparation to meet the hemorrhage should it occur. In every case in which bleeding is obvious or suspected, we have the patient grouped and the blood matched for transfusion. The lives of a great number of patients are lost from hemorrhage because of the time lost before giving the transfusion.

A patient, Mrs. C., was admitted to my service at the Hospital on August 10, 1930, para ii, twenty-eight years old. Her first confinement was a spontaneous, L.O.A., in 1925. Three weeks before admission to the hospital, she had a slight bloody discharge and a rather profuse hemorrhage at home on the day of admission. She was found to be Type IV and to our surprise, her blood was found compatible with each of her three sisters. On the morning of August 11 a vaginal examination revealed the presence of a marginal placenta previa and this was followed by a rather severe hemorrhage. The patient was prepared and had been instilled according to the mercurochrome technic. The membranes were ruptured and a No. 3 bag inserted. This controlled the hemorrhage temporarily and a direct transfusion of 500 c.c. of blood was given. Following the transfusion the bag was found to be through the cervix and was removed. The bleeding continued; a version was done; the cervix soon dilated, and the delivery was easily completed. There was a morbidity for the first five days and I was rather fearful lest she might be developing a postpartum infection, her temperature reaching 103.8 on the third day. A second transfusion was given on the fifth day, the temperature dropped immediately to normal where it remained. On August 12 the blood count showed 2,500,000 red blood cells, with 44 per cent hemoglobin, 14,000 leucocytes, and 88 per cent polynuclears. On August 15, while she was still running the temperature, her red blood cells were 3,200,000 hemoglobin 44 per cent, leucocytes 7,200, polynuclears 68 per cent.

DR. J. O. POLAK.—Both of the previous speakers have spoken about having donors ready. We not only have the donor ready but give the transfusion before we start our work. If you are going to do a cesarean section in placenta previa or in ablatio, I would very strongly advise having the patient transfused if she has lost any considerable amount of blood, before the section is done. It is surprising to see how quickly the uterus will contract and how perfectly she will recover. These patients always have a little secondary anemia, they sensitize themselves to it, but they will not stand the extra shock and trauma of anesthesia without more blood, and the time to give it is before you need it. Another point is, if we are going to do a cesarean section, do it under local anesthesia and we will not have as much immediate or postoperative trouble as with a general anesthetic.

DR. CHARLES A. GORDON.—I do not believe that the treatment of these cases should depend upon whether the case is one of marginal, lateral, or central placenta previa; those are purely academic considerations.

The decision as to the type of operative procedure, if any, that should be employed depends, as has been pointed out, upon the condition and the parity of the patient and the condition of the cervix.

We have handled our cases of placenta previa in a way that is very similar to that pointed out by Dr. Ronsheim, not using cesarean section at all, until lately, when I have been impressed by the fact that the obstetrician should consider the baby. To my mind, sacrifice of the baby does not seem like good obstetrics. The duty of the obstetrician is two-fold—first, to get the patient through with as little morbidity as possible, and, second, to save the baby if possible.

In the final analysis, I believe that the treatment of these cases depends upon what a man feels he can do in placenta previa as in all other types of work. If he feels he is proficient in doing a Braxton-Hicks version and has had considerable experience with it and feels he will not rupture the uterus, as so often happens, and his results are good from that procedure, then I think that is the thing to do. Certainly the statistics presented by Dr. Ronsheim are very impressive. We often see very much worse cases than you have reported here, in Greenpoint Hospital and in St. Catherine's Hospital. Transfusion will never save them; as has happened in some instances rupture of the uterus occurs as part of the operative procedure.

DR. VICTOR L. ZIMMERMANN.—More and more obstetricians are turning to abdominal delivery in cases of placenta previa. I believe it is indicated in primiparae and in multiparae with rigid and undilated cervix. But too much dependence must not be placed upon cesarean section to save the baby; too often we are dealing with premature infants. So, where the cervix is sufficiently dilated or dilatable, and the baby not over large, I think the Braxton-Hicks version is to be preferred. Unfortunately, our troubles are not over with the delivery by whatever method, for we still have the dangers of secondary hemorrhage and. sepsis. The low placental site makes a fertile culture ground for bacteria.

Department of Book Reviews

CONDUCTED BY ROBERT T. FRANK, M.D., NEW YORK

Review of New Books

v. Peham and Amreich's important work on *Gynecological Operations*[1] appears posthumously after the sudden death of the senior author last August. It may be regarded as an exposition of the operative methods current at the first Gynecological University clinic of Vienna, covering as it does, especially the years 1925 to 1930 during which v. Peham was professor.

In this book anatomy is especially featured, with marvelous and profuse illustrations, the majority in colors, 448 in all. Both the text and the illustrations feature particularly the vaginal operation for carcinoma, the abdominal operation for the same disease in which the pelvic anatomy is exceptionally well described.

In the first portion of the volume, which deals with general topics, local anesthesia is described and illustrated most minutely, including the anesthesia of Schuchardt's incision, anesthesia of the spermatic and hypogastric nerves, as well as sacral anesthesia. These descriptions are recommended for thorough study by all gynecologists. In five years of 2290 major operations performed, lung complications developed in 142—114 bronchitis, 24 pneumonias, 4 pleurisies. There were 6 deaths among the pneumonias. Thrombosis and embolism occurred 72 times in the same number of operations. Of these, 66 were definitely diagnosed, a percentage of 2.9. As usual, the highest incidence was noticed among the fibroids, 4.2 per cent, the lowest among operations for ovarian tumors, 1.9 per cent. There were 9 fatalities. Five embolisms of the pulmonary artery occurred. A good anatomic description of the various abdominal incisions is given.

The chapters on anatomy concern themselves to a great extent with the pelvic connective tissues. The endopelvic fascia and its relation to the various intrapelvic structures is clearly demonstrated by beautiful charts.

The chapter dealing with the special gynecologic operations shows that absolute cures in 29.2 per cent were obtained in carcinoma of the cervix but the statistical tables are too incomplete to permit of thorough analysis. Raying is limited to inoperable carcinoma. However, postoperatively, many of the cases are rayed. As a preliminary to operation on cervical carcinoma, thorough excochleation and cauterization immediately before the operation is performed.

v. Peham being a pupil of Schauta, the vaginal operation of carcinoma is preferred. In every instance a deep Schuchardt incision to the point where the vagina is circumscribed to form a cuff is performed. The authors emphasize the importance of demonstrating the proper vaginal layers in which separation should be attempted. The minutest technical details are described both by text and illustration, and emphasis is placed upon possible sources of error.

In the abdominal operation for carcinoma, Latzko's technic is apparently performed. The ureter is exposed throughout its course and then the paravesicle and pararectal spaces are opened, and clamps extending to both of these areas are placed far out on the parametria. Not before this portion of the operation has been completed is the area posterior to the uterus attacked mesial to the fully mobilized ureter. The levators ani consequently are exposed, denuded of their

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[1] *Gynaekologische Operationslehre.* By Dr. H. v. Peham u. Dr. J. Amreich. Berlin, 1930. S. Karger.

fascia. A good description of Wertheim's technic is likewise given. In 258 cases during five years, the operative mortality was 6.6 per cent. In 1253 cases of supravaginal hysterectomy, stump cancers later developed in 0.6 per cent.

A less detailed, although a clear description is given in the operation of simple vaginal hysterectomy, especially for metropathia. Of these cases only 50 per cent were treated by radiation. The operative technic for hysterectomy and fibroid uteri are fully described in the text and well illustrated. In fact, in this section, a number of illustrations could be deleted without affecting the clearness of the description.

Although the difficulty in the diagnosis in ectopic pregnancy is stressed, no mention of the Aschheim and Zondek test for pregnancy is given. In 156 operations for ectopic gestation, only 1 death occurred.

I am glad to note that, although v. Peham is a strong advocate of the vaginal method of approach he strongly advocates the abdominal route in inflammatory conditions. A conservative attitude in the treatment of inflammations is shown. Of 2691 cases 44.7 per cent were hospitalized, the rest being treated ambulantly. Only 227 operations were performed for inflammatory diseases, that is 10 per cent of the entire number, of which 8 died, a mortality of 2.9 per cent.

The description of operations for tuberculosis of the genital tract and of ovarian tumors is much shorter but as the anatomy and technic has been so fully described in connection with other operations, this saving of space is to be commended.

The operations recommended for prolapse are particularly the interposition operation, ventrofixation, the Baldy, and Doléris in connection with anterior and posterior colporrhaphy. Even the operation for complete tear is detailed and illustrated. Apparently the Vienna school still favors exposure and suture of the levatores in posterior colporrhaphy. The operation for cystocele recommended still employs the tobacco pouch purse string on the bladder which, in the United States, has been generally abandoned. The author speaks of fascia overlapping in anterior colporrhaphy without mentioning either Bissell or Rawls.

For the construction of an artificial vagina, Schubert's technic is described with the employment of the lower portion of the rectum. Two of these operations were performed during the last five years, with perfect results.

A short description of vesicovaginal and rectovaginal fistulas is given. Incontinence of urine was operated upon 14 times, all successful, using what corresponds to the Kelly urethral technic, fortified by fascial duplication. This is an exceptionally good record of success. The anatomy and operative treatment of Bartholinian cyst is given in detail, the concluding description dealing with removal of the appendix.

This is an individual book, most carefully worked out, informative and well written. In conclusion I feel justified in once more drawing attention to the wonderful anatomic illustrations. This book will remain a permanent memorial to v. Peham.

—*Robert T. Frank.*

De Mora has written a monograph on *Solid Tumors of the Ovary.*[2]

His classification of connective tissue tumors is conventional. His description of primary epithelial tumors differs greatly from that usually found in the literature, greater emphasis being placed on the supposed origin than appears warranted by our present state of knowledge. Based on the original observations of Winiwarter which has been amply confirmed by modern physiologists and anatomists, he accepts postnatal ovogenesis and classifies a number of malignant

[2] Les Tumeurs Solides de L'Ovaire. By J. Luis E. de Mora. Preface de M. Le Prof. A. Gosset. Paris, 1931, Gaston Doin & Cie.

tumors as originating from these sources. Among them are "seminomas" of the ovary which he compares directly with the tumors of similar name in the testis. As no microscopic illustration of these growths is given, it is difficult to classify them according to the more accepted nomenclature.

He next discusses chorionepitheliomas and folliculomas of the ovary, likewise without illustration. "Pflugörian" epitheliomas and epitheliomas of the corpus luteum are next described and a classification based on superficial papillary growth is likewise given. The concluding paragraphs on primary cancers of the ovary include carcinomata arising from wolffian rests. This chapter on primary carcinoma of the ovary will prove of little value to the clinician or practical pathologist but is worthy of study by those interested in the theoretical etiology of cancer. Although solid teratomas are discussed, this section is likewise not illustrated.

The second half of the book deals with the treatment and diagnosis of ovarian growths.

The third portion contains the history and description of 24 unpublished cases. The follow-up is too incomplete to be of value.

A considerable bibliography concludes this monograph.

—*Robert T. Frank.*

Cuthbert H. J. Lockyer has retired from active practice. He has left his unique collection of obstetric and gynecologic specimens to the Charing Cross Hospital Medical School and made it available and useful by preparing a minute catalogue of the specimens.[3] This collection embraces the material gathered over a period of thirty-five years by a gynecologist who at the same time was one of the best known gynecologic pathologists. More than 1100 gross specimens are available for inspection, fortified by 1800 microscopic sections which refer directly to the specimens preserved for macroscopic study.

The obstetric specimens cover fetuses from the eighteenth day of development on. A number of rare monsters are described. Such rare conditions as tumors of the placenta and of the umbilical cord are included; likewise 4 cases of ovarian pregnancy and a pregnancy in an accessory horn.

Among the gynecologic specimens, 4 sarcomas of the vagina are shown. Both common and rare conditions of all the pelvic organs will be found on the shelves of this collection. Among the unique specimens is a teratoma of the fallopian tube.

The Charing Cross Hospital Medical School is to be congratulated on having at its disposal this wonderful teaching collection which we trust will be kept up and added to by future obstetricians and gynecologists.

The catalogue is made more valuable by numerous references to the literature which accompany the descriptions of both gross and microscopic specimens.

—*Robert T. Frank.*

Dr. Crossen's very extensive revision of his *Operative Gynecology*[4] marks a significant trend in the practice of this specialty. In his inclusion of surgery of the urinary and the intestinal tracts he indicates the widening field which the surgical specialist for the pelvic organs of women and their closely related systems occupies and covers this ground with word and picture in a most thorough manner. This edition, as heretofore, is built around three premises: is operation needed, what operation should be selected, and what to do for the patient before and after the operation.

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[3] Catalogue of the Lockyer Collection of Obstetric and Gynaecological Specimens. By Cuthbert H. J. Lockyer. London, 1930, John Bale, Sons & Danielsson, Ltd.
[4] Operative Gynecology. By Harry S. Crossen and Robert J. Crossen. Ed. 4. St. Louis, 1930, The C. V. Mosby Company.

Consideration of the uterosacral ligaments has been transferred from retro-displacements to the section on uterine prolapse. The recapitulation of operations for prolapse, the suggestions for the type of operation to be selected, and the general plan adopted by the author in treating such cases, brings out all the recent advances in plastic surgery of the pelvis.

The former discussion of fistulas has been evolved into a new and fully descriptive chapter on Genital Fistula. Among other new material we find here Coffey's technic for ureteral transplantation.

Operability and operation risks in myoma of the uterus are clarified. The author refers to the differences in his technic of hysteromyomectomy from those elaborated in some recent popular discussions of the subject, among others Richardson's. In the chapter on carcinoma there is a full discussion of the classification and operability of cancer, the physics of radium and roentgen ray and the indications and methods of their use. A description of the former extensive radical operation has been retained as a guide for the less severe operations which may be indicated in operable cases. Certain palliative procedures as the Percy cauterization and Byrne knife are included. The author stresses the dangers of peritonitis and intestinal paralysis in surgery of endometrial ovarian cysts, and brings out the necessity for drainage in such cases. The surgical treatment of anomalies and malformations of the genital organs is dwelt on at length, considerable discussion being devoted to the subject of formation of artificial vagina, Pemberton's review and Baldwin being quoted extensively.

Lesions of the lower urinary tract and their surgical handling form a new chapter written by Dr. R. J. Crossen, co-author of this edition. In an excellently written chapter by Dr. H. S. Brookes, Jr., are discussed the lesions of the intestinal tract which may be met in association with, or as complications of, diseases of the pelvic organs. This discussion ranges from simple anal fissure excision to resection of the colon; various types of herniorrhaphy are also described. Dr. Brookes has also expanded the few paragraphs on anesthesia in a previous edition to a well-balanced chapter on anesthesia in which he cautions against an enthusiastic overuse of spinal anesthesia.

Over four hundred new illustrations have been added to this edition to correlate the changes in the text. The book will continue to be an invaluable aid to those engaged in surgical treatment of the diseases of women.

—*Philip F. Williams.*

This manual, *The Puerperium*,[5] discusses briefly the normal and abnormal convalescence of the parturient woman. An equal amount of space is devoted to the newborn, healthy and diseased, with a chapter on artificial feeding of infants.

While in some respects the book is sketchy, for instance the discussion of pyelitis and hemophilia, there are many excellent and practical suggestions for the care and comfort of the recent mother and her infant. Among the inconsistencies may be mentioned the almost simultaneous discountenancing and recommendation of chloroform in postpartum eclampsia; among the omissions, the neglect to mention blood transfusion in hemorrhage, anemia, or infection.

—*Philip F. Williams.*

That this *Text-Book of Histology*[6] has reached a fifth edition in fifteen years is evidence of its popularity as a textbook of the fundamental science courses. The format is excellent, the illustrations well executed, and the technical directions clear.

[5]The Puerperium or The Management of the Lying-In Woman and New-Born Infant. By C. Nepean Longridge. Ed. 2, London, 1924, Adlard and Son and West Newman, Ltd.

[6]A Text-Book of Histology. By Harvey Ernest Jordan. Ed. 5, New York and London, 1930, D. Appleton and Company.

That recent advances in allied subjects have also been thoroughly reviewed for inclusion in this edition is shown in the chapter on the reproductive system. Here the latest attitude of the physiologists toward the relation of ovulation, menstruation, and hypophysis function is fully presented. Occasionally the phraseology is slightly obscure, as " . . . that sex differences are largely differences in degree of differentiation; in other words, the femaleness represents in essence inhibited maleness."

—*Philip F. Williams.*

The seventh installment of Hirsch's *Handbuch der Inneren Sekretion*[1] is short and contains three chapters dealing with the importance of lipoid substances in endocrinology. This subject is as yet in its infancy. The first chapter contributed by Berberich and Jaffé covers the morphology of the lipoid metabolism in reference to the endocrine glands. The results obtained by purely histochemical methods appear doubtful. Of chief interest are the changes in the suprarenal glands with their effect on the blood cholesterin.

The second chapter was written by K. Westphal and W. Mann. It covers the clinical-physiology and pathology of lipoid metabolism. Here again the subject of the effect of adrenal diseases on the cholesterin content in the blood, and the cholesterin changes noted in pregnancy are the main contents.

H. Handovsky has written the last chapter which deals with the chemistry of aliphatic lipoids. The chemistry of such bodies as the phosphatides, sphingomyelin, and galactolipines and lipoids mixtures are discussed.

The eighth installment[1] contains an important contribution on development and growth by F. Gudernatsch of New York.

Development and growth are phenomena which are regulated not only by the internal secretory processes and hence regulatable by nonspecies specific influences, but also are affected by nutrition, temperature, light, diseases, etc.

In the period of early embryonal development, the thyroid is one of the strongest agents in producing organ differentiation. The author goes into great detail on all the thyroid effects, and in particular the changes produced in tadpoles. Thyroxin still produces its effect in a dilution of 1 to 100,000,000. The effect of the thymus in mammals is in doubt. The entire history of the growth effect of the anterior hypophysis is discussed in its application to both the female and male gonads.

A short discussion is devoted to human physiologic and clinical phenomena. This chapter is very sketchy.

The phylogenetic position of the internal secretions is described in an interesting fashion. Of the glands of internal secretion, the thyroid appears the oldest, being noticed as the endostyl in forms which are transitional between vertebrates and invertebrates. The other glands are phylogenetically younger, and appear only in the vertebrate series. Other subjects dealt with are growth and differentiation as life processes. Protein is essential and both lysin and other amino acids are especially important.

The subject dealt with by Gudernatsch covers an enormous field. He gives an excellent summing up of this huge amount of material.

—*Robert T. Frank.*

Part I of volume VII of *Handbuch der Speziellen Pathologischen Anatomie und Histologie*[2] covers the uterus and tubes, forming a large tome of 931 pages. The

[1]Handbuch der Inneren Sekretion. Band II. Lieferung 7 und 8. Herausgegeben von Dr. Max Hirsch. Verlag von Curt Kabitzsch, Leipzig.
[2]Handbuch der Speziellen Pathologischen Anatomie und Histologie. Herausgegeben von F. Henke und O. Lubarsch. Siebenter Band. Erster Teil. Verlag von Julius Springer, Berlin, 1930.

largest contributions are those of Robert Meyer, dealing with the pathologic anatomy of the uterus (624 pages), hydatid mole and chorionepithelioma malignum of the uterus by the same author, covering 175 pages, and a shorter chapter on the fallopian tube by Oskar Frankl, 50 pages in length.

The discussion of malformations is somewhat involved. In sharp contradistinction the endometrial changes are most clearly described but the description of the hormonal basis producing the cyclical variations could be improved. Post climacteric bleeding is especially well described. Meyer doubts the existence of an endometritis luetica but accepts and also pictures gumma of the uterus.

Meyer ascribes the etiology of uterine myomata to unripe muscle cells which lie free in the interfascicular connective tissue, by preference in the vicinity of large vessels. The vessels themselves arise genetically from the uterine wall. The author is unwilling to concede any hormonal etiologic influence on the growth of myomata.

Adenomyosis cervicis interna he considers of inflammatory and traumatic origin, and compares such conditions to the invasion by a pseudomucin cyst epithelium into the uterine wall, with resultant muscle hyperplasia when arising from an adherent ovarian pseudomucin cyst.

The description of both cervical and corpus carcinoma is very detailed and sound. In the diagnosis from biopsy which he naturally favors, he states that in general mitotic and nuclear changes appear too late to be of use in the diagnosis of early carcinoma. He emphasizes that his own diagnostic skill has been improved by watching the course of individual cases, difficult to diagnose, over a long series of years. This is sound advice which every pathologist and clinician should take to heart.

The subject of hydatid mole and chorionepithelioma is preceded by nearly 50 pages of introductory matter dealing with the genital changes in placentation, the hormonal changes in pregnancy, etc., which are of great value. He speaks of a subvariety of hydatid mole which he calls ''fibrous hydatid mole.'' The histology, chemical, and biologic diagnosis of both chorionepithelioma and hydatid mole are dealt with in detail.

The value of this classical contribution to gynecologic pathology from the pen of this well-known author, is greatly enhanced by the use of numerous illustrations, many of which are in colors and all of them noteworthy for their accuracy and clearness.

Oskar Frankl deals in a short and rather summary fashion with the diseases of the tubes. In 100 pyosalpinges he found microorganisms in only 32. He considers the only method of classifying salpingitis is through bacteriology, as various stages may exist coincidentally. Frankl believes that salpingitis isthmica nodosa rarely is of inflammatory origin. A definite increase in the number of ectopic gestations compared to normal pregnancy has been recognized in Europe. In 1907 only 1.8-1000, in 1920, 19.3-1000. He agrees with Litzenberg that no true decidua basalis or capsularis is found in ectopic. In contrast to the drawings illustrating Meyer's contributions, those of Frankl are poor and too schematized.

—*Robert T. Frank.*

The first part of the seventh book of the *Handbuch der Mikroskopischen Anatomie des Menschen*[3] consists of two divisions, the first, the Excretory Apparatus by Möllendorff of Freiburg, containing 329 pages, the second, the Female Sexual Organs by Robert Schröder, consisting of 225 pages.

The chapter on the excretory apparatus is divided into four subdivisions: kidney, renal pelvis, ureter, and urinary bladder. There are 259 pages devoted to an

[3]*Handbuch der Mikroskopischen Anatomie des Menschen.* Herausgegeben von W. v. Möllendorff u. R. Schröder. Siebenter Band. Julius Springer, Berlin, 1930.

exhaustive discussion of the finer anatomy of the kidney. Möllendorf's original investigations of the glomerulus have added much to our knowledge of its finer structure. The analysis of the structural units of the glomerulus is clear and illustrated by numerous excellent drawings. It is interesting to note that Möllendorf does not accept differences in the caliber of vas afferens and vas efferens. The conception that glomerular epithelial cells are morphologically and biologically equal to the pericytes of the capillaries is of importance for the interpretation of pathologic conditions. Figure 30 is very instructive. It demonstrates how complicated the histologic analysis of the glomerulus is and shows how tangential flat sections have to be considered. It illustrates the possibility of misinterpretation of structural details. The absence of anastomoses between the glomerular capillaries and the enormous surface area account for the possibility that the glomerulus is the main structure of the kidney employed in the excretion of the urinary substances. There is a detailed description of the tubular portion of the renal parenchyma with good illustrations. Regarding the vascular supply of the kidney, Möllendorf believes that practically all the blood first passes through the glomeruli before entering the capillary system of the cortex. The arteriolae rectae are mainly branches of the vasa efferentia.

A long chapter is devoted to the discussion of storage and excretion of substances through the kidney. In more than 50 pages a survey of the comparative histology of vertebrates is given.

Limitations of space have forced Schröder to confine himself strictly to the genital apparatus of the human female. His treatment of the subject is chiefly morphologic and only microscopic data are considered. The egg cell always remains undifferentiated. In the newborn, graafian follicles which reach the size of six millimeters are regularly found. He considers the uterine bleeding noted in the newborn as a pregnancy reaction. Although due to the female sex hormone secreted by the placenta of the mother, I am forced to regard this reaction in the uterus as a pregravid (premenstrual) sensitization of the uterine mucosa. The abrupt withdrawal of the hormone following birth, in my opinion corresponds exactly to a similar withdrawal (through the excretions) found premenstrually in the adult female. The new counts of the number of ova present in the ovary of the newborn bring this number to about 400,000.

According to Schröder, Westmann's experiment in which he sucked out the granulosa layer from the ruptured follicle of the rabbit a few hours after coitus, and under which conditions no corpus luteum formation took place, offers definite proof that the lutein cells are formed by the granulosa layer and not by the thecal layer. Schröder emphasizes the changes occurring in the tubal epithelium during the menstrual cycle. He describes the uterine changes in all cyclical phases including pregnancy and the puerperium. This author disbelieves in the cyclical vaginal changes reported in the human female.

His treatment of the subject is direct, simple, and compact. Good references to the literature are included. The subject is lavishly and effectively illustrated.

—*Robert T. Frank.*

The sixth edition of Williams' *Obstetrics*[4] shows an increase in size and format, making it a volume of over 1100 pages. Like good wine, this book improves with age. The present edition shows much revision throughout, and 40 additional illustrations have been added. Particular attention has been given to the advances and changes in methods of anesthesia, to the low cesarean section, to the toxemias of pregnancy, and to transfusion.

[4] **Obstetrics. A Textbook for the Use of Students and Practitioners.** By J. Whitridge Williams. Sixth enlarged and revised edition. D. Appleton & Co., New York, 1930.

The internal secretions which now play such a great rôle have been rather summarily dealt with. The "nidatory" luteal hormone is not clearly described.

The author has shown great willingness to accept new data which force him to alter his opinion on various subjects, and admits his change of view in a most frank and gratifying fashion. For example, he is now convinced of the granulosa origin of corpus luteum cells. The acceptance of at least one case of abdominal pregnancy is recorded. Bandle contraction ring, according to Williams, was definitely demonstrated in at least one case of his own.

This volume must be considered one of the most authoritative in the entire obstetric literature of all languages. It is written in scholarly and clear fashion. Only a few major points can be stressed in any review. Of these I desire to mention a number.

In occipitoposterior presentations, if the head has descended low, the author leaves the position to nature unless intervention is indicated by objective changes in mother and child. He never uses ethylene because of its high explosive property. In preference, he uses chloroform anesthesia "a la reine" and for longer anesthesias, nitrous oxide and oxygen. He would limit the use of X-ray for induction of abortion to those nearing the menopause. For induction of labor the employment of castor oil and quinine, followed by an enema and rupture of the membranes has been successful in the proportion of 19 out of 20 cases.

Williams does not believe that DeLee's "prophylactic forceps" should be generally used or recommended. In occipitoposterior presentation, where intervention is required, he uses the Scanzoni maneuver exclusively. The Kielland forceps has no advantage over the Tarnier. He advises against the wide acceptance of Potter's teachings although he gives full credit to Potter as a wonderful technician.

According to the author the various extraperitoneal cesarean sections have come into disfavor and have been replaced by the low cervical cesarean. I cannot refrain from quoting in full the first paragraph dealing with the indications for cesarean section.

"Indications.—With the increasing perfection of surgical technic, and an erroneous idea of the safety of the operation, there seems to be a growing tendency to regard cesarean section as the simplest means of coping with most obstetrical difficulties. At the present time I consider that the operation is being abused, and that not a few patients are sacrificed to the *furor operativus* of obstetricians and general surgeons who are ignorant of the fundamental principles of the obstetric art. This being the case, the conscientious obstetrician should be particularly careful in the recognition of indications for cesarean section."

Cesarean section is particularly unsatisfactory in eclampsia and placenta previa but indicated in premature detachment of the placenta. I cannot agree in any way with Williams who considers the vomiting of pregnancy as due to a constant emission of fragments of villi into the circulation and an increase of folliculin. He considers all vomiting toxic unless other causes are demonstrable. Neurotic vomiting alone is improved by suggestion. For this reason, corpus luteum or other medication has occasionally proved successful. A sharp distinction is drawn between the central necrosis of toxic vomiting and perihepatic hemorrhagic changes in eclampsia.

Williams never induces labor prematurely for contracted pelvis.

In a book of this importance, it is worth while pointing out certain minor inaccuracies which are worth correcting. It was Robert Meyer and not Evans who first described the premenstrual as the "pregravid" reaction. The Aschheim and Zondek test was not first published in 1929 but in 1928 (Klin. Wchnschr. 7: 8, 1928) and therefore antedates Siddall's test. The latter has been entirely superseded in most laboratories by the Aschheim and Zondek test.

It would be better if figures 225 to 230 showed the vulva entirely shaven as this may encourage the casual reader to omit this necessary precaution for full asepsis. To forbid coitus only during the last month of pregnancy seems rather hazardous. The advice of omitting it for the last two months appears sounder to me. Similarly, a full bath, particularly in the case of multiparae at the onset of labor, opens the possibility of entrance of infected bath water into the vagina.

This valuable contribution to obstetrics deserves the continuation of the popularity which it has enjoyed in the past.

—*Robert T. Frank.*

This collection of reprints[5] represents a study of the endocrine glands carried out in the Evans Memorial during the past eighteen years. In it are reviewed a tremendous amount of figures and tables relative to physical, clinical, and laboratory studies on both normal individuals and those suffering from various recognized or obscure disorders of the various glandular systems. Of particular interest to the obstetrician and gynecologist are the study of cases presenting disorders of the male and female gonad, in which the most striking conclusion offered is in regard to pituitary therapy, the necessity for an extraordinary large dosage of anterior lobe material being stressed. Unfortunately no use of the more recent preparations of the ovary is discussed. The lack of a table of contents and of an index renders the collection of small value for reference.

—*Philip F. Williams.*

Granzow[6] has carried out a long series of experimental researches on the relationship of tuberculosis to the normal and reproductive phases of the female generative organs. He discusses the method and results of his studies on guinea pigs which have been infected by intracardiac and intrauterine injections of tuberculosis bacilli in both the pregnant and nonpregnant states. He reviews the effects of produced tuberculosis on abortion, the placenta, organs of the newborn and the puerperal changes of the uterus, and on estrual changes in the nonpregnant animals, and based on these findings considers at length the comparative changes which occur in the human. The monograph is copiously illustrated, with photomicrographs, and there is appended an extensive bibliography germane to the subject.

—*Philip F. Williams.*

Offergeld presents a second edition[7] of his booklet on the hygiene and physiology of the sexual function of women. The booklet could hardly be offered to the laity for their instruction, but might afford information of the type sometimes desired by gynecologists or neurologists to whose attention the results of disorders or disuses of the sexual function are frequently brought.

—*Philip F. Williams.*

Pankow has revised Krönig's[8] small manual for a manikin course in obstetrics. Such a book is of value to a student or physician preparing for a practical examination, in State or National Boards, as the material is presented entirely in the form of questions and answers.

—*Philip F. Williams.*

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[5]**Collected Publications** from the Robert Dawson Evans Memorial for Clinical Research and Preventive Medicine. Boston, 1929.

[6]**Die Wechselbeziehungen zwischen der Tuberkuloseerkrankung and den Generationsvorgaengen im weiblichen Organismus.** Von Dr. Joachim Granzow. S. Karger, Berlin, 1930.

[7]**Der Einfluss des Geschlechtsverkehrs auf das Befinden der Frau,** von Dr. Heinrich Offergeld, Zweite Auflage. Ferdinand Enke, Stuttgart, 1930.

[8]**B. Kroenig's Geburtshilflicher Phantomkurs in Frage und Antwort, Drittle Auflage.** von Dr. O. Pankow. Berlin, Julius Springer, 1930.

Department of Reviews and Abstracts

Selected Abstracts

The Pathologic Puerperium

Bryce, Lucy M.: Some Observations on the Bacterial Flora of the Female Genital Passages in Pregnancy and the Puerperium, with Special Reference to Puerperal Infection. Med. J. Australia 2: 102, 1928.

This study was made to find the relationship of the bacterial flora to pregnancy, labor, and puerperium with the possibility of puerperal infection.

The cases were divided into three groups: (1) 50 delivered in or admitted to the Women's Hospital, in whom there was fever following childbirth or abortion, and who were examined postpartum only; (2) 119 were examined while attending antenatal clinics; (3) 30 patients of group 2 were cultured during labor and the puerperium.

In group 1, the streptococci were the most frequent intrauterine inhabitants, being present in 36 per cent of the cases. The gonococci were present in 8 per cent but not one of the cervical cultures revealed the same organism. The Bacillus coli was rather frequent. The staphylococci, diphtheroids, and gram positive bacilli were considered not pathognomonic. The fever in one case in which Bacillus Melchii was found, was for a short period with complete recovery.

There were two fatalities in the group, one from nonhemolytic streptococci and one from which organisms were recovered but none were considered pathogenic.

In group 2, streptococci were found in 24 of 103 cases (23.3 per cent). Eight of these 103 had temperature postpartum above 100.1 for 24 hours or on two occasions, while only two with streptococci antepartum had elevated temperature during the puerperium.

In the third group the writer found the uteri likely to have any or all of the organisms mentioned present, even though only one organism or a few were found in the antepartum examination. Streptococci were present more frequently in the afebrile than in the febrile group.

The writer believes that with fever in the puerperium, a number of organisms, especially from the uterus, are associated usually with a mild type of disease. On the contrary, the isolation of one strain only may or may not be significant. Many of the streptococci are thought to be members of the saprophytic flora in normal puerperal uteri.

The writer further believes that organisms from the air, skin, and feces may so easily be introduced by various means, that one should hesitate to call any type of flora normal or endogenous.

The investigation of the bacteria in the genital tract gives some idea of the personal hygiene and occasionally one may detect some unsuspected disease, as chronic gonorrhea.

Although these figures are too small to be of any statistical value, the author doubts the relationship between organisms found and the clinical course.

H. C. HESSELTINE.

Bar: **Coitus Infection as a Cause of Puerperal Fever.** München. med. Wchnschr. 31: 1292, 1929.

Bar calls attention to the fact that coitus during pregnancy has been interdicted since the ancient Biblical days. He reports two cases of puerperal sepsis, one of which died. Neither had a vaginal examination before delivery. Careful questioning revealed that both had coitus before the onset of labor. In one case the same organism was demonstrated in the vaginal secretion of the wife and on the prepuce of the husband. The author feels that the obstetrician should emphasize to both husband and wife the importance of sexual abstinence during the latter weeks of pregnancy.

A. SHULMAN.

Ballin: **Pregnancy and Sexual Intercourse.** München. med. Wchnschr. 31: 1293, 1929.

Ballin feels that it is not necessary to insist upon sexual abstinence for the entire duration of pregnancy. Such instructions are usually disregarded by the patient. If she is a healthy woman, no restrictions are necessary during the first five months of pregnancy. Neither abortion nor other injury is likely to be caused in such a patient. This statement does not apply, of course, to patients with genital abnormalities, such as infantilism, retroflexion, habitual abortion, etc. There is, however, real danger in the practice of coitus during the last months of pregnancy. Hemorrhage, premature rupture of the membranes, intra- and postpartum fever are the most important of these dangers. The author therefore advises marked restriction of coitus from the sixth to the eighth month, and complete abstinence thereafter.

A. SHULMAN.

Miller, Douglas, and Whitaker, J. R.: **A Study of the Bactericidal Power of the Blood During Pregnancy and the Puerperium, and its Relationship to the Development and Course of Puerperal Infection.** Brit. M. J. 2: 85, 1929.

The method employed in this study consists essentially in mixing whole blood with a known quantity of bacteria on "slide cells," the bactericidal power being gauged by the number of colonies which develop after incubation for twenty-four hours.

Preliminary facts ascertained were:

1. That after blood has been drawn off, it loses at first slowly, then more rapidly its bactericidal property.

2. The bactericidal power of the blood of a healthy individual does not vary from hour to hour or from day to day.

Conclusions reached were as follows:

1. The degree of bactericidal power in patients who subsequently develop sepsis is lower than in those who do not. If the bactericidal power is well above normal for potentially septic patients immediately after labor sepsis may occur, but the patient's chances of recovery are good.

2. The bactericidal power of the blood varies in different individuals, being highest in the pregnant woman.

3. During pregnancy there is a gradual increase in the bactericidal power of the blood, reaching a maximum at or about the time of delivery. Immediately

following delivery there is a rapid decline, so that by the tenth day it reaches the nonpregnant level; thereafter there is a further temporary increase which has disappeared by the twelfth week postpartum.

4. The antibacterial activity of the blood does not materially differ in the nulliparous as compared with the multiparous pregnant or nonpregnant individual. Within normal limits it does, however, seem to be depressed by the albuminuria of pregnancy, prolonged labor, instrumental delivery, and severe blood loss.

5. Leucocytosis increases during pregnancy, reaching its maximum at the time of delivery and thereafter rapidly subsides. While there is a broad parallelism between the variations in the leucocyte count and the antibacterial power of the blood, the relationship is not a constant one, and the latter property may be due to factors other than, or in addition to, a mere increase in white cells. No relationship exists between the degree of bactericidal power, the number of red blood cells, the percentage of hemoglobin, or the color index.

<div align="right">GEORGE E. HUDSON.</div>

Teoumine, S.: The Blood Platelets in the Prognosis of Puerperal Sepsis. Gynéc. et Obst. 15: 436, 1927.

The author examined 56 patients, most of whom were seriously ill and 11 of whom died of puerperal sepsis. In all, 243 counts were made. The author concludes that the number of platelets undergoes regular, definite fluctuations in the course of septic puerperal infection, which probably reflect the relation between the mechanisms of defense and aggression. Increased quantity of platelets indicates increased defenses on the part of the organism. In the cases with a favorable outcome the number of platelets attained was the largest, but varied greatly, 47,000-604,000. Toward the end, the figure returns approximately to normal limits. In the fatal cases the platelet count is ordinarily low at the beginning, diminishing still more toward the end. The normal variation of the blood platelets is from 300,000 to 400,000 per c.mm. Every increase in the platelet count should be considered favorable, every diminution an unfavorable sign, a fatal prognosis being justified only if the drop is to below normal and persistently so. Such a drop, however, may not be present in very serious cases. This may be explained by the rapid depletion of the defenses of the organism without apparent reaction. There seems to be no constant parallelism between the platelet count and the white and red blood count.

<div align="right">GOODRICH C. SCHAUFFLER.</div>

Laffont and Fulconis: The Prognostic and Specific Value of the Intradermal Reaction to the Streptococcic Filtrate in Puerperal Infection. Bull. Soc. d'obst. et de Gynéc. 6: 420, 1929.

Many intradermal injections of a streptococcus filtered culture were given but no bad reactions were observed. It was found that all the women who showed a positive reaction even during the course of a streptococcus puerperal infection failed to develop septicemia. All those who did not react to the injection developed severe complications which persisted a long time, or died of infection due to streptococcus or other organisms. The authors conclude that the intradermal reaction of streptococcus filtrate possesses a definite prognostic value in cases of puerperal infection. It varies with the patient and during pregnancy. Its intensity diminishes particularly during the last few days of pregnancy and during labor. It is not specific because the filtrates of cultures of different organisms provoke the same result. Infections not due to streptococci modify the reaction.

<div align="right">J. P. GREENHILL.</div>

White, H. Burt: Puerperal Sepsis and Sensitiveness to Streptococcal Toxins. Brit. M. J. No. 3518, p. 974, 1928.

This investigation was initiated to test the reaction of pregnant women to the scarlatinal toxin. This experiment did not altogether make clear the correlation of toxin-sensitiveness with a past history of scarlet fever or streptococcal infections.

Of 100 pregnant women, 27 were sensitive to a dose of 1/5 c.c. of a dilution of 1 in 1,000 scarlatinal toxin injected intradermally. Eight of the "toxin-sensitive" women experienced morbid puerperia. From the cervices of those examined a pure growth of streptococcus pyogenes was obtained. Labor was altogether normal in 6 of these cases, and normal in the remaining 2, except for slight postpartum hemorrhage.

Of 100 pregnant women, 73 gave no reaction to scarlatinal toxin; two of these exhibited morbid puerperia (British Medical Association standard), but in neither case could streptococci be found in the cervix or blood.

Thirteen of the nonreacting women, or 19 per cent, sustained difficult labors but healthy puerperia; 6 of these were examined bacteriologically, but in no case was Streptococcus pyogenes found.

Operative interference increased the rate of sepsis almost ten times.

Summarizing the situation following this investigation of over 2,000 cases, the author comes to the conclusion that vaccines are of secondary importance in the prevention of sepsis as compared with the conservative and aseptic treatment.

ADAIR-JOHNSON.

Stent, Lois: The Dick Test in Relation to Incidence of Puerperal Infection. Lancet 1: 1066, 1930.

The Dick Test was used on 500 women; 248 in the last week of pregnancy, 152 during labor, and 100 within twenty-four hours after delivery. In all there occurred 9 severe postpartum infections, 5 of which had been Dick negative and from the blood stream of 4 of these the Streptococcus hemolyticus was isolated. Two deaths occurred in this last group. Although this organism was the only one recovered from the blood, there were mixed infections locally, two with Bacillus Welchii. The hemolytic streptococcus was found in the uteri of 6 other Dick negative patients.

Both anaerobic and aerobic cultures were used throughout this study, but the streptococci were not so classified.

The failure of the streptococcal toxin to measure the immunity of these patients may be explained by: the associated trauma of parturition, mixed infections locally, very invasive strains, or unidentical hemolytic streptococcal strains. Consequently the writer repudiates the use of this test for determining susceptibility to streptococcal puerperal infection.

H. C. HESSELTINE.

Salmond, Margaret, and Turner, Beatrice: The Dick Test in Pregnancy. Brit. M. J. 2: 145, 1929.

Results were as follows: Of 533 women who received the Dick test 70 per cent were negative. Of 158 Dick positive reactors 15 per cent became febrile.

As the Dick reaction is only a test of streptococcal antitoxin in the blood, and as fever in these cases was due to numerous causes no attempt being made to determine if it were due to streptococcus or not, it is difficult to see wherein the experiment is of much practical value.

GEORGE E. HUDSON.

Bublichenko: Bezredka's Antivirus in Prognosis and Prophylaxis of Puerperal Sepsis. Russk. Klin. 11: 547, 1929.

In this study the author employed, by means of intradermal injections, Bezredka's antivirus, a filtrate of old broth cultures of many different strains of streptococci and staphylococci.

A marked redness within from four to twenty-four hours and local tenderness for several days represent a positive reaction.

Among 154 patients suffering from puerperal sepsis the writer found the reaction strongly positive in 113, moderately positive in 23, slight or negative in 18. No patient of the first two groups died. Of the remaining 18 with slight or negative reaction 5 died of sepsis and 13 recovered. Patients with a history of scarlet fever showed a positive reaction in 95 per cent.

Naturally the thought suggests itself of using this antivirus as prophylactic measure. The author employed it also locally in form of vaginal tampons and observed rapid healing of puerperal ulcers and quick resorption of exudates.

His conclusions are: A negative reaction is prognostically unfavorable, while a positive reaction permits a favorable prognosis. Intradermal injections of the antivirus in doses of 0.2 c.c. increase the patient's resistance against puerperal infection.

<div align="right">ALEXANDER GABRIELIANZ.</div>

Delmas and Brémond: The Preventive Treatment of Puerperal Infection with Sulpharsenol. Bull. Soc. d'obst. et de Gynéc. 17: 433, 1928.

The idea of treating puerperal infection with sulpharsenol originated with Rivière. Since November, 1927, in the Montpelier Maternity sulpharsenol has been given to every patient during whose labor the asepsis was questionable. During three months 67 patients were given this drug. In only 33 of these cases was the puerperium afebrile and in five cases the fever was due to extragenital causes. There was no mortality in the remaining 29 patients who had fever and the majority of these patients were not very ill. The authors believe that sulpharsenol did not reduce the morbidity of puerperal infection but its prophylactic value rested in the benignity of the infection which resulted in most of the cases.

<div align="right">J. P. GREENHILL.</div>

Le Lorier: A Few Successful Results With Intravenous Injections of Novarseno-benzol in Puerperal Sepsis. Bull. Soc. d'obst. et de Gynéc. 18: 453, 1929.

The author is firmly convinced that the intravenous injection of novarsenobenzol in cases of puerperal septicemia is very helpful and he reports seven cases to prove his contention.

<div align="right">J. P. GREENHILL.</div>

Pfalz, G. J.: The Influence of Specific and Nonspecific Protein Bodies on the Bactericidal Power of the Blood in Staphylococcic and Gonorrheal Infections of the Female Generative Organs. Arch. f. Gynäk. 134: 73, 1928.

The author used the method devised by Wright for testing the bactericidal powers of the blood in three cases of hematogenous postabortal sepsis, in three cases of exudative posterior parametritis, and in two cases of breast abscess. There were no changes in the bactericidal index in the five cases of localized purulent staphylococcus infections but in the three cases of generalized infection, the bactericidal index followed exactly the temperature and clinical course. Pfalz believes that the determination of the bactericidal index has definite prognostic

value. Following nonspecific, specific, or combined protein injections there is a definite rise in the bactericidal power of the blood. This rise is always definite and occurs as follows: First there is a negative phase lasting less than one hour. This is followed by an active labile phase for a number of hours following each injection; third, there is a continuous and steady rise in resistance from the inauguration of the treatment until the optimal dose is given. The author also believes that the specific antigens produce a nonspecific bactericidal process which does not correspond to the formation of specific antibodies.

RALPH A. REIS.

Anderodias: The Modern Treatment of Puerperal Infections. J. de méd. de Bordeaux 59: 95, 1929.

Anderodias attacks the patient from three standpoints, first, those cases where infection is suspected but has not yet developed; second, where the infection is present and still localized; and finally, where the infection has spread beyond the confines of the pelvis and a general septicemia has developed.

From a prophylactic standpoint, besides close observance of aseptic technic, he advocates subcutaneous injections of sulpharsenol. In a series of 1166 deliveries where this was used the maternal mortality was zero.

Treatment of evident puerperal infection: (a) *Serotherapy.* This form of treatment is deficient because of the polymorphism of the streptococcus. (b) *Vaccinotherapy.* The results from this form of treatment when given subcutaneously have not been brilliant. Where local immunization by direct application of the vaccine to the infected area has been attempted the results have been more satisfactory. (c) *Immuno-transfusion.* The blood of a person who has become immunized against the streptococcus is transfused into the patient. The results have not been striking. (d) *Chemotherapy.* Such chemical compounds as acroflavine or mercurochrome 220 are injected into the blood stream. Among them sulpharsenol is the best and should be administered in doses of 12 to 18 centigrams.

(e) *Surgical Treatment.* The operations which have been advocated are hysterectomy, venous ligation or resection, and laparotomy with extensive abdominal drainage. Could one be sure that the infection were limited to the uterus, hysterectomy would undoubtedly give excellent results. However, in the majority of cases, the infection spreads rapidly to the parametrial tissues. Hysterectomy, therefore, should be reserved for very special cases such as multiple uterine abscesses, complicating fibroid tumors, and secondary uncontrollable uterine hemorrhages. The mortality in puerperal thrombophlebitis treated surgically is about 54 per cent as compared with a 25 per cent mortality under medical treatment. In general peritonitis, laparotomy and extensive abdominal drainage have yielded slightly better results than medical treatment.

In reviewing the various forms of treatment Anderodias concludes that all douches should be avoided. In the localized conditions gauze soaked in horse serum or antistreptococcus bouillon should be applied locally each day. In the case of endometritis, where the condition is not due to a lochiometra, gauze soaked in horse serum should be packed into the uterus daily. In lochiometra it will prove sufficient to establish drainage. In cases of generalized septicemia the local treatment should be continued and everything done to maintain the general resistance of the patient at the highest possible point and, in addition, "abscess of fixation" induced by injecting 2 c.c. of essence of turpentine into the antero-external region of the thigh. If no reaction occurs within forty-eight hours a second injection is made one centimeter from the first. The injections of sulpharsenol up to 18 centigram doses should be continued.

THEODORE W. ADAMS.

Item

American Board of Obstetrics and Gynecology

The following names have been added to the list of Certificate holders published in the February issue.

BARNARD, EVERITT	PHILADELPHIA, PA.
BECK, A. C.	BROOKLYN, N. Y.
BRETTAUER, JOSEPH	NEW YORK CITY
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CORNELL, E. L.	CHICAGO, ILL.
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FURNISS, H. DAWSON	NEW YORK CITY
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For further information apply to the Secretary, Dr. Paul Titus, 1015 Highland Bldg., Pittsburgh, Pa.

Original Communications

THE HUMAN UTERINE MUCOUS MEMBRANE DURING MENSTRUATION*†

BY GEORGE W. BARTELMEZ, PH.D., CHICAGO, ILLINOIS

PART I. INVOLUTION AND VARIABILITY

SOME seven years ago Carey Culbertson and I laid plans for testing the endometrioma hypothesis of Sampson by applying cytologic methods to the study of such tumors. This necessarily involved a comparison of the internal organs of tumor cells with those of the normal elements of the uterine mucous membrane. A survey of the literature showed that no real cytologic study had been made on any mammal and so it was necessary to study first the changes in the nuclei, mitochondria, Golgi apparatus, etc., of normal cells during the entire menstrual cycle. Incidentally various statements were found in the literature which required checking up. The most astonishing concern the vascular supply, which ought surely to have received careful attention considering the great importance of that fundamentally vascular phenomenon, menstruation. No one has ever followed the vascular changes with reference to the cycle, yet the differentiation between the various types of bleeding and especially the understanding of the factors which control menstrual bleeding depend upon such a study. Our knowledge of the blood vessels of the uterus during the period of the flow is derived entirely from the study of fixed material and very little is known of the effects of fixing agents upon

blood vessels. Adequately preserved menstruating uteri are so rare that there are no satisfactory descriptions or figures of the associated rhexis and diapedesis. So far as the lymphatic vessels are concerned, we do not have as yet a conclusive demonstration of their presence in the mucous membrane at any stage of the cycle.

The entire body of uterine research is small in comparison to the wealth of histologic and physiologic work, human and comparative, that has contributed to our understanding of other viscera and glands. The reasons for this are not far to seek. The reproductive system is usually the first to show abnormalities in animals under laboratory conditions. In order to understand the uterus, it is necessary to study a large number of normal organs seriated with reference to an external sign and removed at definite times in the sex cycle. The changes must be correlated with the ovarian changes. The various species of mammals differ in the details of the cyclic changes for many are correlated with mating behavior and placentation; the latter process has reached the height of diversification among mammals. One cannot therefore, without great care, carry over the observations made on one species to another. So far as the human cycle is concerned, detailed comparisons are possible only with other primates, for the function of menstruation is confined to this order. Monkeys are costly and until recently it has not been possible to keep them normal in the laboratory. Consequently the bulk of our knowledge concerning the uterus has been contributed by practicing gynecologists and obstetricians on the basis of material from the clinic. Certainly no group of specialists has a keener or more general interest in the fundamental problems of its subject and what little work they have done is good. But the methods that have been employed have necessarily been of a routine character, and with three exceptions, limited in number. Only two accounts of a gross study of the living uterine mucous membrane have been published (Schroeder, Hinricks and Kessler, 1926, and Markee, 1929). No one has made comparisons between fresh cells and those in histologic preparations, although, from the histophysiologic point of view this is essential. Studies on the secretions leave much to be desired; it is an especially great handicap that the difficulties of collecting secretion in quantities for chemical study seem insuperable in most cases. The physiologists have not contributed much; the necessity of controlling every experiment by a careful study of histologic preparations has deterred most of them from entering the field. The chief advances on the comparative side have been made by zoologists like Heape and F. H. A. Marshall and by American anatomists who have followed the trail in physiologic histology blazed by Mall and Bensley. In the work that has been done most of the effort has been concentrated on finding criteria for certain stages of the cycle and no exhaustive histologic studies have been

made. In brief it may be said that in no mammal has the uterus been studied with sufficient thoroughness or with all the resources of modern histology for elucidating its functions.

During the past six years we have obtained 315 uteri, most of them from Dr. Culbertson's clinic. The majority he dropped into fixing fluid as soon as he had removed them;* we prepared a series of uteri for cytologic study by fixing blocks from the same specimen in six or more different fluids, from three to ten minutes after they had been removed. In certain cases a study of fresh tissue in normal saline solution was made with the aid of immersion lenses.

At this time I wish to report only on some findings from the least known phase, namely, the period of the flow. There are two reasons for doing this in advance of the presentation of the general cytologic study, first because certain recent observations on the physiology and histology of the female reproductive system have necessitated a modification of the current theories of the cycle and second, because the variability in our own material cannot be fully explained on the basis of the best substantiated theory we have at the present time, *viz.*, the theory of the human menstrual cycle which has been developed during the last twenty years largely by Robert Meyer and R. Schroeder on the foundations laid by Bischoff, Hitschmann and Adler, L. Fränkel, and others. It may be summarized as follows:

While the uterine mucous membrane is reorganizing after a menstrual flow, a graafian follicle begins to grow and the uterine mucous membrane rapidly thickens. Typically, ovulation occurs during the second week after the beginning of a flow (cf. Allen et al., 1928). The subsequent development and physiologic activity of the corpus luteum are associated with a hyperemia and often an edema of the mucous membrane, together with an enlargement of the component cells,† which has, by the beginning of the fourth week of the cycle, reached the condition usually termed "premenstrual."‡ If the ovum has not been fertilized, the corpus luteum degenerates and menstruation ensues. This has become so important a feature of the theory that R.

*We are also indebted to him for the pathologic diagnoses and for obtaining as complete and accurate menstrual histories as possible. I owe much to Dr. R. R. Bensley for inspiration and criticism. Dr. J. L. O'Leary and Miss C. M. Bensley have given me invaluable help in the course of the work; the latter is responsible for the data concerning glycogen. Case XV was obtained through the kindness of Dr. H. O. Jones.

†Dr. O'Leary has under way a detailed statistical study of this matter and of the nucleocytoplasmic ratios in the gland cells during the various phases of the cycle.

‡Since this is exactly the condition found in the decidua vera of the earliest normal implantation stages, as for example the Kleinhans ovum of Grosser (1922) and the Miller ovum (Streeter, 1926), it may be called "pseudopregnant" following Hill and O'Donoghue (1913). This term has been adopted by those who are familiar with the conditions in marsupials where pseudopregnancy is most strikingly manifested. R. Meyer (1924) has objected to the term "premenstrual" for, as he says, it is equivalent to saying that a student takes a course of study in order to fail in the final examination. He has proposed the term "pregravid." This does not emphasize the fact that the changes in the entire reproductive system are practically and perhaps exactly the same during the first two weeks after ovulation, whether fertilization occurs or not. Corner's (1927) term "progravid" is more euphonious than "pseudopregnant" and also expresses the generally recognized adaptive character of the condition. When one wishes to use a noun, "pseudopregnancy" is the best term we have.

Meyer (1924) has not hesitated to say that there can be no true menstruation except following ovulation and corpus luteum formation. The emphasis on this phase of the theory is a sequel to the fundamental postulate that the periodic growth and ripening of graafian follicles are the prime movers in the recurrent cycles of the mammalian female reproductive apparatus. This has been taken for granted ever since Bischoff's monumental studies (1842 to 1854). As details have accumulated since then, and as more species have been studied, it has become increasingly obvious that the fundamental physiology of the cycles is the same in all mammals (cf. Hartman, 1929) and until very recently no objections have been raised to Bischoff's general theory. In 1926, however, Parkes reported the occurrence of successive and typical estrus cycles (including mating behavior) in mice which had been sterilized with x-rays, some before and others after reaching sexual maturity. Brambell, Parkes and Fielding (1927) described the characteristic changes associated with estrus in the uterus and vagina of such sterilized mice. The ovaries contained nothing resembling a normal follicle. They found that eventually the bulk of the ovary consisted of embryonic cells proliferated from the germinal epithelium which had replaced the degenerated follicles and which, so far as they could see, showed no evidences of cyclic change; nevertheless, the cycles promptly ceased after double ovariotomy as they did in cases where the proliferated tissue underwent degeneration. Its origin is the same as that of the follicular epithelium; the two tissues would seem to be related physiologically as well (Parkes, 1929). These observations, which have been confirmed by Zondek and Aschheim (1927), demonstrate that in the mouse, the estrus cycles are independent of the growth and maturation of ovarian follicles. We may assume that the rhythm is controlled by the same mechanism in all mammals; we must at least hunt for this control outside of the ovary. While the ovary is undoubtedly a necessary link in this mechanism, for without it the genital tract soon atrophies, yet the control may well be located elsewhere. Moore (1930) has presented a stimulating hypothesis in this connection which explains a wealth of evidence for an alternation of ovarian and hypophyseal activity.

There is also certain evidence from the primate cycle which necessitates a modification of the theory outlined above. The most obvious feature of this cycle is menstruation. It has been shown that in various of the higher monkeys there may be periodic bleedings from the uterus, clinically indistinguishable from menstruation, which occur in the absence of large follicles or corpora lutea. This was first described by Heape (1894 and 1897), and confirmed by van Herwerden (1906); the conclusive evidence was first obtained by Corner (1923 and 1927) who was in a position to appreciate its significance fully. He has been able to show that in the Macaque, ovulation is followed by

a typical pseudopregnancy and in the absence of fertilization, menstruation ensues. This is in full agreement with the theory. However, menstruation may occur at the expected time although an exploratory laparotomy done one to two weeks previously showed no evidence of a corpus luteum or a large follicle. In these cases autopsy revealed no sign of large follicles or recent corpora lutea and also proved the animals normal. Under these conditions then, there is bleeding from an "interval" mucous membrane, associated with some loss of tissue. This is not due to the abnormal environment of the laboratory for such menstruation was described by van Herwerden in monkeys shot in the jungle. She explained it as characteristic of the sexually inactive period (cf. Hartman, 1930). The reason she did not ascribe it to the absence of a preceding ovulation was that she found four menstruating uteri which showed no evidence of a pseudopregnant hypertrophy of glands or arterioles, although a corpus luteum was present in each case. No adequate evidence was presented, however, that any of these four corpora belonged to the last cycle previous to the killing. Corner's findings on Macacus rhesus have been confirmed by Allen (1926 and 1927), by Hartman (1927), Joachimovitz (1928), and we have observed a similar case.

These observations on other primates become particularly significant in the light of the evidence that menstrual bleeding may occur at the expected time in women although there has been no preceding ovulation. Corner (1927) has cited several cases from the literature in which the evidence was convincing.

I can add another from Bischoff (1854, Case xiv) who gives the available data in full so that an interpretation can be made in the light of our present knowledge: He found blood in the uterus and vagina of a young woman who had drowned herself on the fifth day after the beginning of a period, but the uterine mucous membrane was not hypertrophied as in his other cases of menstruation. While this was hardly to be expected on the fifth day, yet there was no large follicle or a recent corpus luteum in either ovary. Those who are familiar with Bischoff's papers will not question the accuracy of his observation. Although there was the testimony of the girl's roommate that her periods were regular and that she had actually menstruated at the expected time, Bischoff did not regard the case as sufficient to overthrow his theory because the girl's mistress was convinced that the last menstruation was feigned in order to conceal a pregnancy. There was, of course, as Bischoff says, no sign of pregnancy. This would now appear to have been a case of that type of menstruation which usually occurs in monkeys outside of the breeding season and may occur at other times.

Two of the human cases cited by Corner agree with this one in all essential features. In most reported human cases of menstruation without preceding ovulation, one or more large graafian follicles were present and this was taken at the time as proof of the coincidence of ovulation and menstruation. We now have reason to believe that large follicles found at the time of menstruation are atretic. They may, nevertheless, be associated with pseudopregnant development of

the uterus, as was first described by Leopold (1877, Case 1) and conclusively proved by Stieve (1926) who studied the material from a panhysterectomy done on the twenty-third day of the cycle. In this case the histology of the uterus was typically "progravid" but instead of a corpus luteum, he found only a 14.8 mm. graafian follicle containing an ovum with the first maturation spindle. This state of affairs might be interpreted as meaning that the mature or early atretic follicle has similar effects on the uterine mucous membrane as the corpus luteum. There are doubtless differences but what they are we have yet to discover. At all events the finding of pseudopregnancy in a human uterus cannot be taken to prove that ovulation has preceded this state, although that is undoubtedly the ideal situation. It may be that occasionally an over-ripe follicle is induced to rupture late in the cycle and this might explain the abnormal development of such ova as Bryce-Teacher I and Möllendorff "Sch." Certain it is that when a large follicle is present in the ovary late in the cycle, the uterine mucous membrane does not present the picture of hyperplasia which is frequently associated with "small cystic degeneration" of the ovary. There is good evidence that extracts of the corpus luteum produce effects which cannot be obtained with the follicular hormone (Hisaw et al., 1927, Corner and Allen, 1929, Van Dyke and Gustavson, 1929), at least in certain mammals. Since one or more large cystic follicles are found so frequently in human ovaries removed during the second half of the cycle, especially when there is no corpus luteum, we can understand why menstruation from an "interval" mucous membrane is so rare in this species. The uterus removed on the third day which was figured by Palmer Findley (1902) may be such an one; unfortunately, neither clinical data nor a description of the ovaries was given in this case.

While we may say that ovulation and corpus luteum formation associated with progravid development of the uterine mucous membrane, *typically* precede menstruation in women, yet the exceptions prove that the theoretic deductions drawn from this association are not justifiable. The mechanism is not a rigid machine which will not work if the gears do not all engage. Specifically, the vascular changes of menstruation are loosely correlated with the ovary and pseudopregnancy and they may occur in the absence of the latter. Conversely, as we shall show below, it is probable that ovarian hormones may continue to stimulate the mucous membrane after bleeding and the resulting degeneration have begun (cf. p. 640).

MATERIAL

The majority of the Culbertson specimens are uteri removed because of fibromyoma or fibrosis uteri, or come from defundations done in cases of pelvic peritonitis following salpingitis. Practically all speci-

mens were removed by the abdominal route and with care to prevent trauma. In the entire collection there are 33 cases removed during the second half of the cycle, which have either a normal mucous membrane or one with *normal areas*. In 12 of these, a recent corpus luteum was also obtained. All of them show a degree of progravid change corresponding more or less closely to the theoretically expected stage. We have others removed sixteen days or more after a flow which show little or no evidence of pseudopregnancy, but as R. Meyer (1924) has pointed out, these can always be explained as coming from amenorrheic phases, so that they cannot give evidence regarding cycles without ovulation. From the period of bleeding, we have 21 specimens, 14 of which can be regarded as normal on the basis of their histologic appearance and clinical histories. There are 6 cases from the first day, 3 from the second, 2 from the third, 2 from the fourth, and 1 fifth day case. Since different regions of the same specimen show different stages of the process of menstruation, the material is not so meager as may appear at first sight. All our menstruating specimens, but two, show evidence of having been progravid during the preceding cycle; in 3 of them corpora lutea were obtained which belong to that cycle; 9 have histologic evidence in the mucous membrane of an antecedent pseudopregnancy.

The total number of menstruating uteri which have been studied histologically since Kundrat and Englemann (1873) is still so small that no one can be justified in setting up a norm for the process. We need a large series of detailed descriptions, generously illustrated, of individual selected cases so that in time a sufficient number may be accumulated to serve as a basis for an account of the normal variability on the different days of bleeding. Lack of space prevents such detailed accounts of our specimens at this time.

The present study has thrown new light on several phases of the menstrual process. At this time we shall present some evidence as to the extent of the tissue loss and on the variability found in the same and in different uteri.

INVOLUTION AND THE EXTENT OF TISSUE LOSS

The old problem concerning the loss of tissue during menstruation can be regarded as settled. Schroeder (1913-1928) has concluded that the entire compact and spongy strata are lost during the flow. Sekiba (1923), who studied sections of uterine mucous membrane obtained by placing a cap pessary over the portio vaginalis as well as sections from 14 uteri removed during menstruation, concluded that the stratum compactum and only a part of the spongiosum were lost. Novak and TeLinde (1924), after a study of 12 selected cases of patients who were operated upon during menstruation, supported Schroeder's contention that the entire spongy layer had been lost by the third day. They

removed the organs with the greatest care to meet the objection that the manipulation during the operation might be responsible for much of the tissue loss. Froboese (1924) emphasized the individual variability in the amount of tissue lost while Shaw (1926) was inclined to believe that all of the spongy zone is shed. The possibility still remains that the regular pelvic examination of the patient in late progravid stages may influence conditions* observed during menstruation. Until we have a large series of uteri fixed promptly enough to avoid postmortem changes from women with normal pelves (accident or sterilization cases), where, in addition, the bleeding can be established as an expected flow, we shall not be in a position to speak with certainty concerning the normal range of variability; i.e., to establish a norm for the process of menstruation. At present there are not even enough normal specimens to fully evaluate the possible effects of pelvic disease. In the interim we must rely for controls upon studies of other primates such as those of Heape (1894 and 1897), van Herwerden (1906), Joachimovitz (1928), and notably Corner (1923 and 1927) who alone has had adequate menstrual records.

Sekiba's conclusions regarding tissue loss have been challenged from Schroeder's laboratory by Bohnen (1927) who pointed out that the early desquamatory phase, which may result in a relatively slight loss, is followed by a crumbling away of the surface, cell by cell, a process particularly emphasized by Novak and TeLinde. Bohnen alone has appreciated the need of a landmark for determining the extent of tissue loss, for, as he says, the thickness of the mucous membrane is too variable for measurements to be of any value in this connection. He used as a landmark the spiral arterioles which in sections often appear as a group of transversely and obliquely cut vessels and which he terms "vascular fields." He believed these to be confined to the basal zone and when he found them at the surface of the mucous membrane in late stages of menstruation, he concluded that the entire overlying spongy zone had been lost. It will be remembered, however, that Leopold (1877) described spiral arterioles near the surface. In serial sections the vascular fields are seen to extend far up into the "functional" zone, both in progravid stages (Fig. 6) and in such menstrual stages as still have most of the stratum spongiosum intact. The arterioles then only give us evidence that some stratum spongiosum is lost. We need some reliable landmark, for it is undoubtedly true that ordinary sections of late menstrual stages present a superficial resemblance to the stratum basale of progravid stages. This has no significance because of the extensive involution at the beginning of a period, the significance of which I have pointed out (1928 American

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*Schroeder has attributed to the preceding bimanual examination the extravasation of blood which is almost always to be found somewhere in the mucous membrane of uteri removed at operation, irrespective of the phase of the cycle. This matter deserves further study.

Anatomical Meeting). We must consider this problem before it is possible to discuss the question of the extent of tissue loss.

Involution.—Recent writers in presenting the evidence for tissue loss seem to have forgotten the menstrual involution, upon which the older writers placed so much emphasis. In his latest presentation, Schroeder (1928) does not even mention it, yet if one studies his figures 67 and 68 critically it is obvious that the great difference in thickness between them is not due primarily to loss of tissue (cf. Fig. 1). No one appears to

A.   *B.*

Fig. 1.—Photographs ×20 of sections illustrating involution of uterine mucous membrane at onset of menstruation. Black line between figures indicates boundary between mucous membrane and muscle. (Cf. Schroeder, 1928, Figs. 67 and 68.) No retouching in this or in any of photomicrographs.

(*A*) Case 1. Twenty-eighth day of cycle, menstruation is imminent. The mucous membrane was from 3.7 to 4.9 mm. thick in 95 per cent alcohol (therefore more shrinkage than in *B*).

(*B*) Case 6. (First day.) From area where no tissue has as yet been lost. The mucous membrane from 1.5 to 2.2 mm. thick in neutral formol.

have made a series of measurements to determine the extent of involution and its place in the sequence of events.

Our original survey of the blocks of uterine tissue in alcohol made it clear that on the first day of the flow in regions where the surface epithelium was still intact, there had been a striking reduction in the thickness of the mucous membrane as compared with progravid stages.

Such measurements can readily be made for the epithelium may stand out very clearly under these conditions, as may be judged from O'Leary and Culbertson (1928, Fig. 15, which presents a photograph from our Case 2). Table I is based on measurements of such material. Only the thickest area of any given menstruating specimen is considered, where tissue loss could be excluded.

TABLE I. THICKNESS OF PROGRAVID AND MENSTRUATING MUCOUS MEMBRANES MEASURED ON BLOCKS OF TISSUE IN ALCOHOL

	PSEUDOPREGNANCY (19 CASES)	MENSTRUATION (8 CASES FROM FIRST AND SECOND DAYS)
Maximum thickness noted	7.3 mm.	3.2 mm.
Minimum thickness noted	1.9 mm.	1.2 mm. (The maximum in one case)
Average maximum measurements	4.24 mm.	2.29 mm. (46 per cent loss)
Average minimum measurements	3.34 mm.	Not included as tissue loss may be involved
General average	3.80 mm.	

From this it appears that the average *maximum* thickness at the outset of menstruation, in regions where no tissue has been lost, is about 68 per cent of the average *minimum* of progravid stages; it is 60 per cent of the general average and but 54 per cent of the average maximum for pseudopregnancy. The striking changes in the appearance of the mucous membrane may be seen by comparing A and B of Fig. 1. Such a reduction can be interpreted only as an involution. Its outstanding features are: (1) A more or less complete collapse of the glands due to the discharge of secretion (cf. Fig. 1) and a reduction in the size of the cells (cf. Figs. 9 to 12). (2) A loss of edema fluid. This, with the infiltration, makes the stroma appear much denser than in progravid stages. Both these conditions are as characteristic of menstruation as the vascular phenomena. (3) A reduction in the blood volume of the mucous membrane where the capillaries are collapsed. To what extent the actual loss of blood is involved in the early phases of involution of which we are speaking, must remain in doubt. The specimen illustrated in Fig. 2 has areas where involution appears to have preceded bleeding from the surface. Loss of blood was, of course, regarded as the chief factor in involution so long as hyperemia was believed to be the chief cause of "premenstrual tumefaction" and the mucous membrane was simply a "blood sponge," filling and being squeezed out again.

How is this reduction which precedes desquamation brought about? There is no intrinsic mechanism for the discharge of the glands. The hyperemia in our material is not great enough to explain it. I would suggest as a working hypothesis that the relaxation of the myometrium which characterizes menstruation (Lahm, 1926) involves a

stretching of the mucous membrane so that its thickness is reduced and the secretion and edema fluid are pressed out. The dilatation of the previously virtual uterine lumen is further increased by the addi-

Fig. 2.—Photograph ×20 of section across body of uterus removed on first day of flow. Case 2. Begins with menstrual congestion at right and precedes to extravasation and desquamation in passing to upper left-hand side of figure. Blood in vessels and free in tissues appears black.

tion of extravasated blood and then there is further stretching of the mucous membrane. This would explain another condition that has been repeatedly described in later menstrual and early repair stages,

viz., the occurrence of glands extending almost parallel to the surface. The reduction in the size of the gland cells and later of the stroma cells also plays a part in the involution. Since this amounts to almost 50 per cent at the very outset of menstruation, it is necessary to have a landmark that can be followed continuously if we are to determine the extent of tissue loss. We must have characters which will enable us to identify the spongy and basal zones in progravid stages and throughout the period of menstruation. The gland form is useful in this respect for even at the time of reepithelization it is often possible to recognize the larger size and greater irregularity in shape which

Fig. 3.—Photograph ×30 of section from same case as Fig. 2, showing areas of congestion and extravasation. * Indicates the union of two dilated superficial venules with a radial collecting vein, in a congested region. ↓ Indicates extravasation throughout capillary bed supplied by one radial arteriole. Extravasation may therefore be localized.

characterizes glands of the spongy zone (Fig. 5). They are, of course, much simpler than in the progravid stage for the involution of the gland cells is progressive, but the series of changes can be followed. The irregular or "sawtooth" form becomes more and more blurred and the diameter of the tubules approaches that of the basal zone. It must be remembered, however, that from early progravid stages on, it is not rare to find typical "spongiosa" glands adjacent to the muscle and at best the boundary between the two zones is vague in ordinary histologic sections after the second day of the flow. The differentiation between the zones is clear in Bielchowsky preparations where the

reticular framework is specifically stained. The only investigator who has considered the changes in the reticulum during the cycle is Sekiba (1923), but he did not describe or figure its appearance during menstruation. Our Bielchowsky preparations show no change in the form of the reticulum in the deeper layers during menstruation. It remains looser in the spongy zone and many of the fibers are more

Fig. 4.—Photomicrograph ×200 of silver preparation showing reticular framework. Case 14 (fourth day). Edge of spreading sheet of surface epithelium indicated by ↓. Form of glands and of reticulum indicates presence of both spongy and basal zones (cf. Fig. 5).

delicate than in the basal stratum. Fig. 4 is taken from a uterus removed on the fourth day from a patient who usually bled for three or four days (Case 14). The new surface epithelium is beginning to spread from the free ends of some glands; below it both spongy and basal zones can easily be differentiated by the character of glands and especially by the looser superficial reticulum. There can be no doubt

here but that some of the original spongy zone has persisted and would have been reorganized later in the repair stage. The specimen has many regions where the remaining part of the spongy zone appears to be disintegrating. One might perhaps assume that all this loose tissue is moribund, but the cells show no evidences of degeneration; furthermore, epithelium can be found spreading out over other similar re-

Fig. 5.—Photograph ×20 of section of corpus and fundus from Case 14 (fourth day) showing variability in amount of tissue lost in different regions of same mucous membrane. In depths of fundus (bottom of figure) relatively little tissue has as yet been lost. Arrows ← indicate spots where entire spongy layer is gone; elsewhere, both spongy and basal layers can be recognized. At * a dilated gland, and just below it a gland of the progravid type. Compare thickness of mucous membrane with Fig. 1.

gions (Fig. 8). The subsequent expansion of the connective tissue cells of such areas would account for the sudden appearance later on, of a broad regenerative zone of Sekiba. In contrast to these findings of a persisting stratum spongiosum, one can find minute spots where nothing is left but the stratum basale. Two such are indicated by
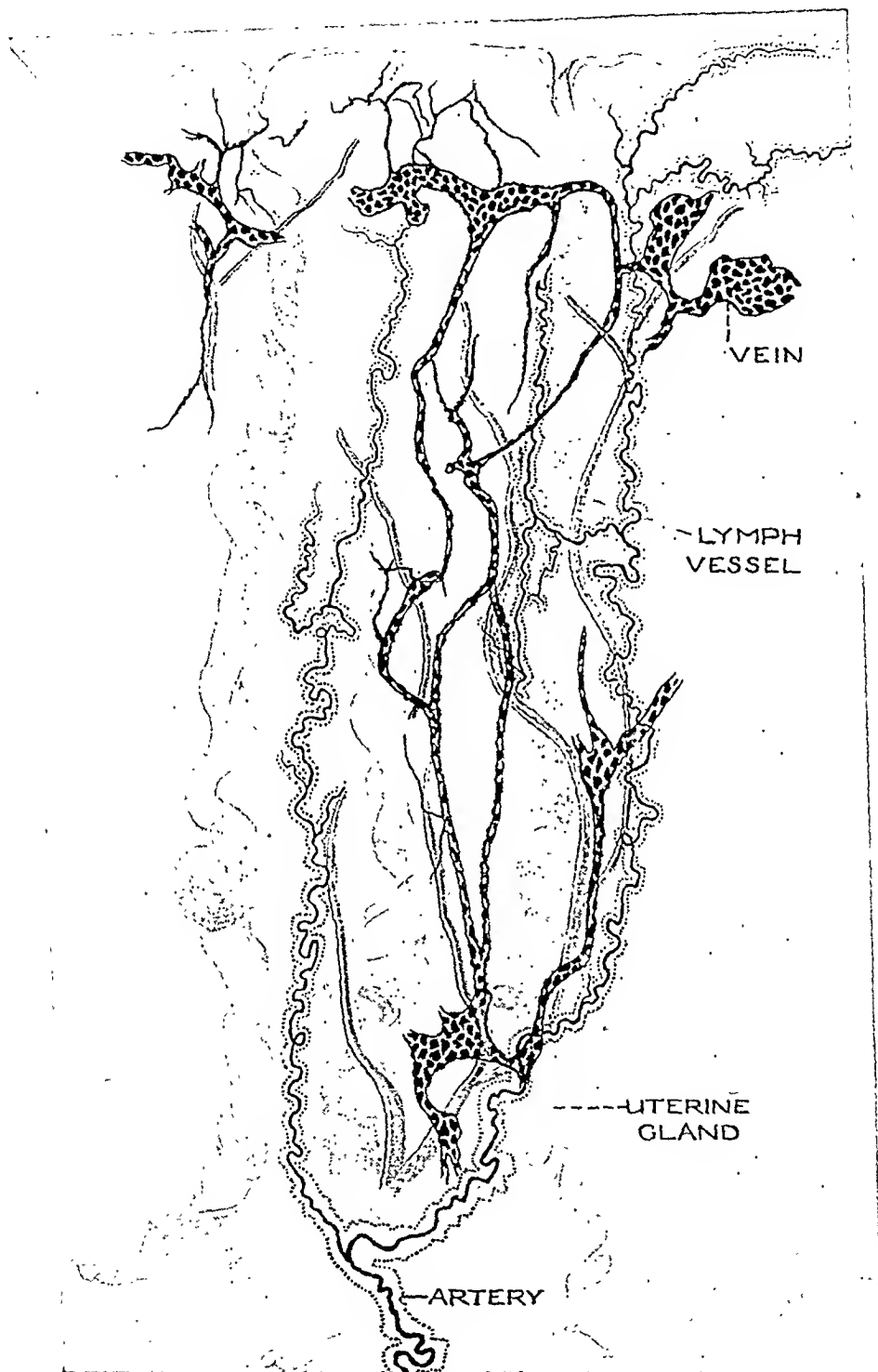
Fig. 6.—Projection reconstruction of glands and vessels from mucous membrane removed twenty-three days after beginning of last period. (Pseudopregnancy.) Note subepithelial arteriole, muscle of which was differentially stained. Lymph vessels followed through series and their independence of the veins demonstrated. (×38)

Vein   Lymphatic   Artery
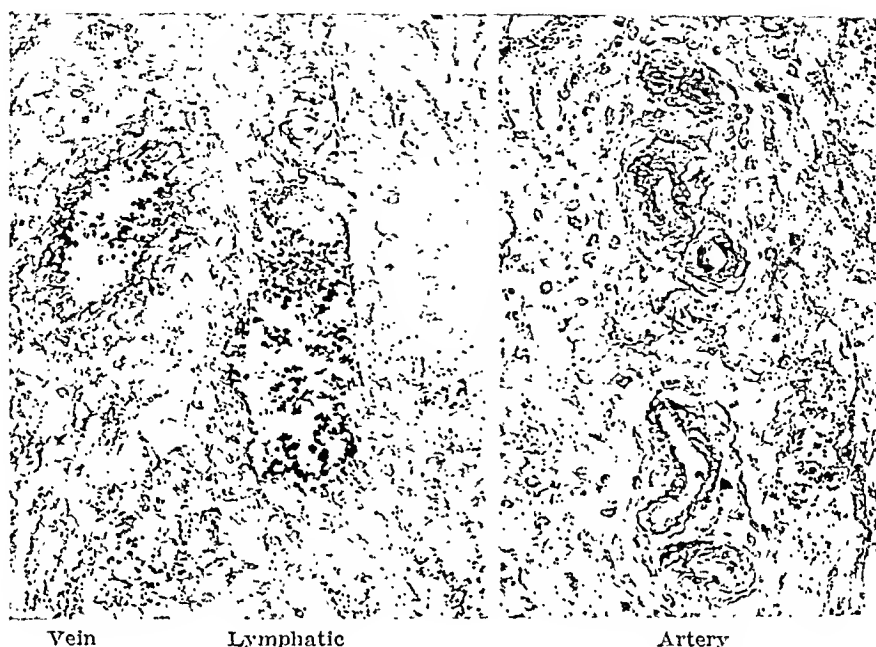
Fig. 7.—Photomicrographs ×200 from one section of series used in making reconstruction shown in Fig. 6. Note that vein has heavier reticular wall than lymphatic. Both contain only coagulated serum in this section.

Fig. 8.—Photomicrograph ×250 from section of corpus uteri (Case 15, fifth day). New surface epithelium has spread over an apparently disintegrating area. Red blood corpuscles appear black.

arrows in Fig. 5. To judge from our material, this is rather the exception than the rule. If, however, we recognize even the sporadic loss of the entire spongy zone, we must admit the probability of all degrees of spongiosa loss from minimal to total. If now, in addition, we consider the part played by involution, as well as the variability in thickness of the mucous membrane as a whole and of its strata at all stages of the cycle, then we are left with no basis for an estimate
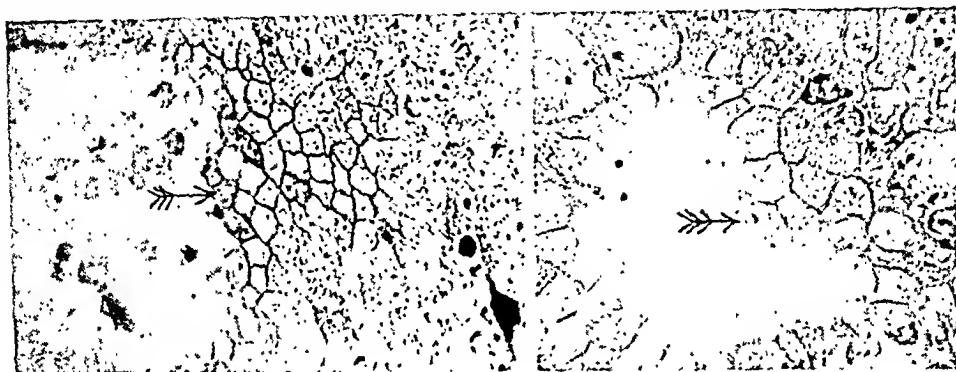
Fig. 9.   Fig. 10.

Figs. 9-12.—Photomicrographs ×800. Fig. 9. Case 8 (second day). A group of cells cut parallel to the surface of epithelium at the level of terminal bars. Compare their size with that of progravid cells in Fig. 10.

Fig. 10.—From mucous membrane removed on the seventeenth day (pseudopregnancy). ↓ Indicates group of cells cut transversely, including terminal bars.
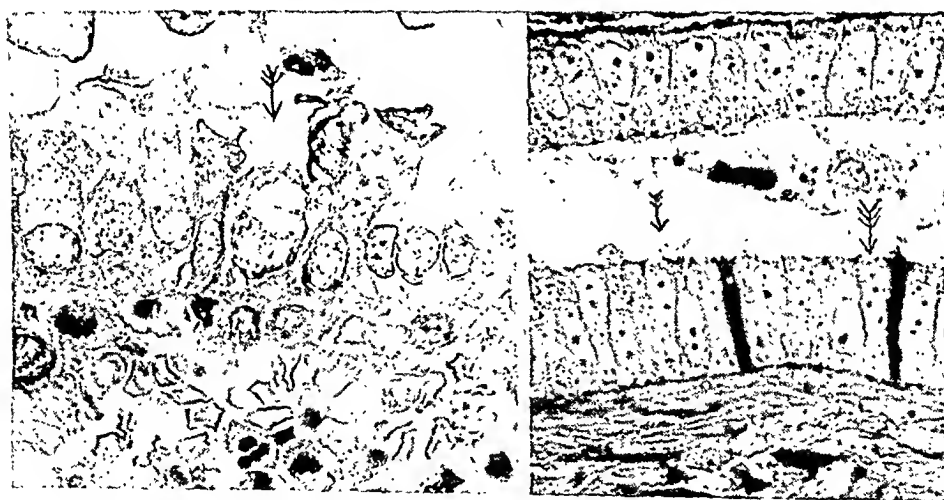
Fig. 11.   Fig. 12.

Fig. 11.—Group of progravid cells from Case 2 (first day). Cell indicated by ↓ shows advanced stage of hydropic degeneration; cells on either side of it show second (progravid) type of secretory activity and contain glycogen (deeply stained). Note extravasated blood and degenerating stroma cells below epithelium.

Fig. 12.—From same material as Fig. 9, showing two rod cells. Cells indicated ↓↓ illustrate the first or mucoid type of secretory activity which is the only type seen in menstruating uteri after the first day.

of the proportion of stratum spongiosum that is typically lost. Nevertheless, our understanding of the process of menstruation and repair must be influenced by the evidence that the loss is usually not so great as has been recently maintained.

THE SIGNIFICANCE OF THE VARIABILITY DURING THE FIRST TWO
DAYS OF THE FLOW

There are two features which vary strikingly in otherwise comparable mucous membranes: first, the presence or absence of massive extravasation, i.e., the superficial $\frac{1}{4}$ to $\frac{1}{2}$ is not always blood-soaked as in the case illustrated in Figs. 2 and 3. Second, there is a significant variation in the evidences of secretory activity in the gland cells. In Case 1 (twenty-eighth day) the general appearance of the mucous membrane is progravid (Fig. 1-A). However, the gland cells lack the characteristic blebs usually seen in the progravid stage and contain little glycogen. The abundant secretion in the gland lumina demonstrates the antecedent activity. The reduction in glandular activity may be interpreted as evidence of the "failure" of the corpus luteum which, in this alcohol fixed material, had highly vacuolated granulosa lutein cells. There are various other evidences of impending menstruation in this specimen, yet there are only a few small hemorrhagic spots, probably due to trauma (we are dealing here with a defundation). In the light of Case 2, we may say that this is an instance in which the stimulus to secretion ceased before the bleeding into the lumen began. Case 2 (Fig. 2) was removed less than eight hours after the onset of bleeding and likewise has little evidence of secretory activity although in some areas there has been, as yet, no extravasation. The same is true of Cases 3 and 7 which, like Case 2, have abundant evidence of a preceding pseudopregnancy. Contrariwise, the other three cases from the first day (Cases 4, 5, 6) have many gland cells of the progravid type and contain more glycogen than Cases 2, 3, and 7. In Case 4, two mitoses in superficial stroma cells were also found. In other words, there is sometimes evidence of corpus luteum activity after menstruation has begun. The second day cases present similar but less extreme differences. The obvious explanation of all this is that bleeding is the most stable of these recurrent phenomena, that the stimulus to secretory activity from the ovary ceases sooner in some cases than in others with reference to the onset of bleeding, and that the vascular changes leading to extravasation are not controlled by the follicular apparatus. Conversely there are instances of clinically typical menstruation in the absence of a corpus luteum (p. 627). That the "failure" of the latter "causes" menstruation is by no means established. To be sure the surgical removal of the corpus luteum in women is usually followed by uterine bleeding (see Watrin, 1924), but we must insist that all extravasation of blood in the mucous membrane is not menstruation. Thus there is good evidence in primates of a normal intermenstrual hemorrhage (for this literature, see Schroeder, 1928, Simpson and Evans, 1928, and Hartman, 1929b) and of an implantation hemorrhage, the "placental sign" of Long and

Evans (1920), which Hartman (1929a) has demonstrated in the macaque. Furthermore, a flow resembling menstruation may follow a series of folliculine administrations in women (Brouha and Simmonnet, 1926) and this even in spayed monkeys (Allen, 1928), although in the latter case, the full progravid development of the uterus had not been previously attained. As yet we know practically nothing of the physiologic or histologic differences between these types of bleeding. On the other hand, it will be recalled that Keller and Schickelé (1911) reported "premenstrual" mucous membranes removed immediately after menstruation and that Joachimovitz (1928) had similar cases. It is possible then to find in addition to the ideal cases: (1) Cases where bleeding occurred at the expected time although no corpus luteum was formed; (2) cases in which the corpus luteum had begun to "fail" before the onset of bleeding; (3) cases in which the activity of the corpus luteum persisted after bleeding had begun.*

All these types are associated with variations in the appearance of the mucous membrane. To dismiss them as "abnormal" or "atypical" would be a convenience no doubt for pedagogic presentation, but progress toward our only goal, the truth, calls for the following of every clue. These "irregularities" all point toward the relative independence from the ovary of the vascular control of the uterus and I am convinced that our understanding of the physiology of menstruation will be furthered by working on this hypothesis. Obviously, the first step must be a detailed study of the cyclic changes in the vascular system of the uterus.

VARIABILITY IN DIFFERENT REGIONS OF THE SAME UTERUS

At all stages of the cycle, it is possible to find regional variations in the degree of development of the mucous membrane of the corpus uteri, but I have found nothing corresponding to the placental sites described by Heape (1894) and van Herwerden (1906) in monkeys. Joachimovitz (1928) mentions variability and states that the median regions of the dorsal and ventral walls undergo the most marked progravid development, but this simply means that it is less at the lateral angles and in the depths of the fundus. In all our menstruating specimens the process has gone farther in some regions of the corpus uteri than in others, and one may meet with such extreme differences as are shown in Fig. 2 (cf. Sekiba, 1923, and Meyer-Ruëgg, 1926, for similar cases). Even on the second day one may find some areas where the surface epithelium is still intact. In one fourth day case

*Since the above was written, I have killed a macaque on the third day of a flow which began twenty-five days after the previous one, and found a mucous membrane which was 2-3 mm. in thickness, had suffered but little loss of tissue and had new epithelium over much of the surface. The corpus luteum appeared "in full bloom" and contained little osmic reducing fat (osmication after fixation in formol Zenker). Such conditions may, in the human species, account for cases of relatively slight loss during a flow as well as for instances of progravid glands and abundant glycogen postmenstrually.

there are all stages from superficial degeneration (depths of fundus, Fig. 5) to almost complete destruction (Fig. 5↓↓) and on to reepithelization (Fig. 4). Case 15 (fifth day) presents similar variability, and various stages of repair are to be seen. We are dealing perhaps with differences in response of different vascular areas as is suggested by the observations of Markee (1929). He obtained convincing evidence that rhythmic vascular changes in isolated bits of uterine mucous membrane are not controlled by the nervous system but by a hormone and found that two pieces transplanted to the same eye usually have different rhythms. It may be then, that there is a degree of physiologic isolation of certain regions in the intact uterus so that they respond differently to a given stimulus (cf. Fig. 3).

SUMMARY

Tissue Loss Following Pseudopregnancy.—The premenstrual invasion by leucocytes is followed by a reduction of nearly 50 per cent in the thickness of the mucous membrane (Fig. 1). This precedes extravasation and desquamation. It involves a discharge of the dilated glands and of edema fluid and is ascribed to the relaxation of the myometrium. The dilatation of the previously virtual uterine lumen with fluid contributes progressively to the stretching of its lining. Another factor in involution is the reduction in the size of the gland cells (Figs. 9 to 12).

After extravasation the loss of tissue involves part of the spongy zone. The remainder of the mucous membrane comes to resemble superficially the basal zone of progravid stages. It is essential therefore to follow the boundary between spongy and basal zones throughout the menstrual period. The form of the spiral arteries is of no value for this, and gland form is not wholly adequate. The reticular framework of the basal zone remains denser than that of the spongy zone (Fig. 4), and since it is possible to recognize both zones beneath newly forming surface epithelium, it is concluded that the entire spongy zone is not always lost. All loose tissue on the surface of the menstruating uterus is not necessarily lost (Fig. 8).

Variability and Its Significance.—In specimens from the first day, the gland cells show great variability in the degree of involution. The explanation offered is that in some cases the stimulus to secretory activity from the ovary continues longer than in others with reference to the onset of the vascular changes that result in extravasation. That is, corpus luteum activity may cease before or persist after bleeding has begun. In these cases then, as in cases of menstruation without preceding ovulation (p. 626), we have evidence that the control of the vascular apparatus is independent of the cyclic ovarian changes. The cessation of menstruation after complete ovariotomy is explained

as due to the insusceptibility of a mucous membrane which has become anemic or atrophic.

Variability in different regions of the same mucous membrane is a constant feature during menstruation as well as at other stages of the cycle. In the later stages of the flow, it is as real although not so striking as it usually is on the first day (cf. Figs. 2 and 5). The variability involves the time and extent of extravasation and extent of tissue loss. This indicates a certain independence of the various terminal branches of the arterial tree.

REFERENCES

Allen, E.: Anat. Rec. 35: 1, 1926. *Idem:* Contrib. to Embryol., Carnegie Inst., Wash. 19: 1-44, 1927. *Idem:* Am. J. Physiol. 85: 471-475, 1928. *Allen, E., Pratt, J. P., Newell, Q. U., and Bland, L.:* J. A. M. A. 91: 1018-1020, 1928. *Bartelmez, G. W.:* Anat. Rec. 35: No. 1 (abst.), 1927. *Idem:* Anat. Rec. 38: No. 1 (abst.), 1928. *Bischoff, T. L. W.:* Ztschr. f. Ration. Medic. N. F. 4: 155, 1854. *Bohnen, P.:* Arch. f. Gynäk. 129: 459-472, 1927. *Brambell, R., Parkes, A. S., and Fielding, U.:* Proc. Roy. Soc. 101: 29-59, 1927. *Brambell, R., and Parkes, A. S.:* Ibid. 101: 95-114, 1927. *Brouha, L., and Simmonnet, H.:* Bruxelles-méd. No. 42-45, 1927. *Corner, G. W.:* Physiol. Rev. 3: 457-482, 1923. *Idem:* J. A. M. A. 89: 1838-1840, 1927. *Corner, G. W., and Allen, W. M.:* Am. J. Physiol. 88: 326-346, 1929. *Englemann, G. J.:* Am. J. Obst. 8: 30, 1875. *Findley, Palmer:* Am. J. Obst. 45: 509-512, 1902. *Grosser, O.:* Ztschr. Anat. u. Entwkges. 66: 179-198, 1922. *Hartman, C. G.:* Anat. Rec. 35: 13, 1927. *Idem:* Bull. Johns Hopkins Hosp. 44: 155-164, 1929. *Idem:* J. A. M. A. 92: 1992-95, 1929. *Idem:* Am. J. Obst. & Gynec. 19: 511-519, 1930. *Heape, W.:* Phil. Trans. Roy. Soc. London 185B: 411-471, 1894. *Idem:* Phil. Trans. Roy Soc. London 188B: 134-166, 1897. *Herwerden, M. A., van:* Monatschr. f. Geburtsh. u. Gynäk. 24: 730-748, 1906. *Hisaw, F. L.:* Physiol. Zool. 2: 59-79, 1929. *Hill, J. P., and O'Donoghue, C. H.:* Quar. J. Micros. Sc. 59: 133-174, 1913. *Joachimovitz, R.:* Biol. Gen. 4: 447-540, 1928. *Keller, R., and Schickelé, G.:* Monatschr. Geburtsh. Gynäk. 34: 621-645, 1911. *Kundrat, H., and Engelmann, G. J.:* Wien. Med. Jahrb., 1873. *Lahm, W.:* Zentralbl. f. Gynäk. 50: 2699-2704, 1926. *Leopold, G.:* Arch. f. Gynäk. 2: 110, 1877. *Markee, J. E.:* Am. J. Obst. & Gynec. 17: 205, 1929. *Meyer, R.:* Arch. f. Gynäk. 122: 585-602, 1924. *Meyer-Ruëgg, H.:* Arch. f. Gynäk. 110: 274-296, 1918. *Idem:* Arch. f. Gynäk. 133: 747, 1928. *Moore, C. R.:* Proc. 2nd Intern. Cong. Sex Research, 1930. *Novak, E., and TeLinde, R. W.:* J. A. M. A. 83: 900-906, 1924. *O'Leary, J. L., and Culbertson, C.:* Surg. Gynec. Obst. 46: 227-239, 1928. *O'Leary, J. L.:* Am. J. Anat. 43: 289-346, 1929. *Parkes, A. S.:* Proc. Roy. Soc. London, Ser. B. 100: 172-199, 1926. *Idem:* Proc. Roy. Soc. Ser. B. 104: 171-188, 1929. *Parkes, A. S., and Brambell, F. W. R.:* J. Roy. Mic. Soc. 42: 97-106, 1927. *Schroeder, R.:* Der Normale Cyklus der Uterusschleimhaut, 1913, Berlin. *Idem:* Monatschr. f. Geburtsh. u. Gynäk. 39: 3-21, 1914. *Idem:* Arch. f. Gynäk. 104: 27-102, 1915. *Schroeder, R., Hinricks, R., and Kessler, R.:* Arch. f. Gynäk. 128: 94-176, 1926. *Idem:* In Veit-Stoeckel. 1: 2te Abt., 1928. *Sekiba, D.:* Arch. f. Gynäk. 121: 36-60, 1923. *Simpson, M. E., and Evans, H. M.:* Science 68: 453, 1928. *Stieve, H.:* Ztschr. Mik. Anat. Forsch. 6: 351-397, 1926. *Streeter, G. L.:* Contrib. Embryol. 18: 31-48, 1926. *VanDyke, H. B., and Gustavson, R. G.:* J. Pharm. Exper. Therap. 37: 379, 1929. *Watrin, M.:* Etude histochimique et biologique du corps jaune de la femme, 1924, Thèse, Liége.

SOME FUNCTIONAL CRITERIA OF NORMAL PREGNANCY*†

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SOME ten years ago, the author and his associates began a study of certain phases of the metabolism in normal pregnancy as a basis for later investigations of the toxemias, a method of approach that had already yielded concrete results in another field.[1] While there was a scattered literature, the earlier lack of accurate methods for the analysis of the urine, of the blood, and the determination of other objective data had led to contradictory reports and thus failed to establish authoritative criteria. It was patent at the outset that single measurements on isolated cases would fall far short of the significance attaching to continuous studies both ante- and postpartum on the same individual. The adoption of this procedure added materially to the labor involved and to the difficulties of performance, as the element of sustained cooperation by the patients assumed a dominant rôle. The advantages were more than compensatory, however, and the work has been carried out on this basis.

For the purposes of the entire program of investigation, subjects for study were drawn from two independent and sharply differentiated sources. Group I was recruited primarily from the patients reporting to the prenatal clinic of the Robinson Memorial, supplemented by a few volunteers drawn from private sources. The women of this group were all living in their own homes under no dietary or other special control, their pregnancies taking place under the conditions of their individual habit of life.

Groups II and III, on the other hand, were patients selected from the inmates of two nursing homes for unmarried mothers. Here the conditions were diametrically opposite as the individuals were under constant dietary and hygienic control, in short, living under uniform standard conditions and following a regimen largely foreign to their usual practice. Further, in this group, there was a psychic factor with a number of the cases arising from the conditions of the pregnancy. Normal healthy individuals were selected initially and only those retained who maintained this condition throughout the period of study. The elimination of those who developed apparent abnormality and the defection of the much larger group whose interest waned as the study progressed has limited in a most material way the number of completed cases. Considerably more than 200 patients were at least par-

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tially studied, to yield the series of 77 that forms the basis of these reports. The actual composition of the group and certain descriptive details can be most compactly presented in tabular form.

TABLE I. COMPOSITION OF SERIES

DATUM			GROUP			TOTAL OR AVERAGE
			A	B	C	
Number of Cases			25	21	31	77
Age	High	(yr.)	37	40	28	40
	Low	(yr.)	18	13	14	13
	Average	(yr.)	28	18	19	22
Parity	High		6	2	2	
	Low		1	1	1	
	Average		2.4	1+	1+	—
Weeks of Study:						
Antepartum	High		34	13	25	34
	Low		11	4	6	4
	Average		21	8	14	15
Postpartum	High		10	10	30	
	Low		1	2	5	
	Average		2	6	14	8

The only point of remark is the large number of young mothers; this depends, naturally, on the source from which so large a part of the group was drawn. In another study, embracing several hundred patients, the average age was twenty-seven. On the basis of comparisons between the younger and older in the present group, the figures here presented may be regarded as truly representative.

Many of the results of this study have already been presented in detail elsewhere in the literature,[2] and reference is made to these papers for methods and similar data. The present communication summarizes them, offering in compact form a pattern of function levels to serve as criteria of normality during pregnancy. That this physiologic episode produces a wide variety of changes in the normal nonpregnant metabolic levels has long been recognized; the purpose here is to give them arithmetical expression so that real departures from the normal levels of pregnancy may be justly evaluated both in direction and amount. Postpartum data are included only as they serve as a control on the antepartum values. With this introduction, the data may be presented without further discussion.

1. *Physical Measurements.*—As many of the final results depend upon, or are correlated with, certain easily obtained biometric magnitudes, these may first be considered. Significant data are collected in tabular form.

These values are for *magnitudes* that remain substantially constant throughout the course of the pregnancy. They serve primarily to illustrate the representative character of the individual variations, and,

equally, the excellent degree of correlation between the averages of the several series.   (Table II.)

TABLE II.   PHYSICAL MEASUREMENTS

DATUM		GROUP			AVERAGE
		A	B	C	
Height					
High	(cm.)	175.0	172.1	167.4	
Low	(cm.)	148.0	147.3	151.8	
Average	(cm.)	158.8	160.4	160.2	159.8
Trunk Height					
High	(cm.)	88.0	91.3	91.5	
Low	(cm.)	79.0	79.5	80.6	
Average	(cm.)	84.3	85.1	85.7	85.1
Sitting Height Index, Av.*		0.531	0.531	0.534	0.532

*Dreyer's[3] Sitting Height Prediction (v. i.)

The observed weight relations constitute one of the important biometric variables.   Certain significant data are given in Table III.

TABLE III.   WEIGHT RELATIONS

DATUM	GROUP			AVERAGE
	A	B	C	
Av. Observation, A.P. (wk.)	21	8	14	15
Gain Per Week				
High (kg.)	0.74	1.03	0.90	1.03
Low (kg.)	0.15	0.02	0.15	0.02
Average (kg.)	0.32	0.52	0.59	0.48
Weight, 1 Week A.P.				
High (kg.)	84.8	81.2	87.0	87.0
Low (kg.)	53.4	48.4	49.8	48.4
Average (kg.)	67.0	64.4	66.8	66.3
Weight, P.P.				
High (kg.)	76.0	74.6	74.9	
Low (kg.)	43.1	40.4	43.2	
Average (kg.)	57.8	57.1	57.2	57.4
Average Interval (wk.)	2.0	3.5	5.0	3 5
Total Loss in Weight (kg.)	9.2	7.3	9.6	8.9
Weight of Child				
High (kg.)	4.32	4.09	4.04	4.32
Low (kg.)	2.41	2.00	2.38	2.00
Average (kg.)	3.31	3.20	3.28	3.27
Net Loss in Weight (kg.)	5.9	4.1	6.3	5.6
Weight Deviation, P.P. Average	+5%.	+1%	–1%	–*

*Unequal observation periods.

The weight one week antepartum has been selected for presentation rather than the extrapolated value for the day of delivery.   The general consensus of opinion concedes a slight loss in weight during the few days before delivery, although there is a lack of uniformity in the

expression of the amount and duration of the decrement.   The present figures avoid a controversy not relevant to the present thesis.

The well recognized increase in weight in excess of that conditioned by the growth of the uterus and its contents finds arithmetical expression here as does the restoration to substantially normal weight during the postpartum period.   Only the sitting height ("trunk length") prediction is used as the chest values are independable, as will be shown later.

The extremes of the growth coefficients, 0.3 kg. and 0.6 kg., may be regarded as reasonably representative, both for the group bearing the cares of a household during pregnancy, and for that living a more protected life under institutional care.

As these data ultimately are to serve as criteria for comparison with toxemic cases, an appreciable number of whom are bedridden and cannot be weighed, they may be utilized to develop methods for calculation of body weight.   Some years ago I derived a formula for the calculation of body weight from the girth of the hips at the point of maximum circumference,[4] which took the following form:

$$\text{Female body weight (in grams)} = 1.387 \times \frac{0.429}{} \sqrt{\text{Hip girth (in cm.)}}$$

This formula was based upon measurements in an erect posture.   The present study demonstrates that the hip girth standing averages 0.7 cm. greater than when measured in a recumbent attitude.   A correction of $+0.7$ should therefore be added to the latter measurement.   Correlating the observed weights with those calculated by the above formula, it can be shown that 5 per cent must be added to the usual prediction to bring over 90 per cent of the calculated values to within ± 10 per cent; the average deviation is 4.2 per cent, of those actually measured.   As this maximum variation permits of the prediction of the basal rate by either the Harris-Benedict[5] or Aub-DuBois[6] equations to within ± 5 per cent, it may be regarded as giving a reasonably satisfactory approximation.

Another line of approach comes in the use of the two prediction formulas of Dreyer (l. c.) based respectively on sitting height and chest girth.   Both were developed to define normal criteria for comparison with observed values, thus giving an arithmetical expression to degrees of over- and under-weight; they naturally were derived from individuals of normal body configuration.   As the sitting height remains practically unchanged during pregnancy, the deviations from prediction produced by the weight increment show a progressive upward trend.   The chest girth, on the other hand, increases with increment of adipose, and, as these experiences have demonstrated, at a more rapid rate than does the weight.   Further, the individual departs more and more from normal habitus, and thus a negative deviation is

produced. To illustrate, from the data, a pregnant woman weighing 63.3 kg. is $+26$ per cent above prediction from her sitting height of 82 cm. and -22 per cent below from her chest girth of 82 cm. The algebraic mean of these two observations is $+2$ per cent, an entirely satisfactory calculation. The algebraic mean of these two predictions, as with the modified hip formula, shows over 90 per cent which will give values within the permissible limits of ± 10 per cent. This study has shown, further, that the chest measure in a recumbent posture is 0.8 cm. greater than with the erect subject from which Dreyer's values are derived. The correction then is -0.8 cm. There remains but one other point to be considered. In the paper already cited[4] the author has shown that the sitting height in the recumbent female can be secured by adding 1.1 cm. to the length from perineum to the vertex, as measured in a recumbent position with special calipers.

2. *Urine Examination.*—Only twenty-four-hour collections were examined. These were kept over toluene at low temperatures during collection and analyzed within a few hours (usually less than three) after completion. The significant results are reported in Table IV.

TABLE IV. URANALYSIS

DATUM		PARTUM	
		ANTE-	POST·
Volume	(c.c.)	1680	1260
Specific gravity		1.0170	1.0187
Albumin	(+)	26.0%	22.0%
Sugar	(+)	35.0%	42.0%
Indican (increased)		12.0%	20.0%
"Urobilinogen"	(+)	1.2%	0
Total acid (c.c. N/10 acid)		580.0	570.0
NaCl	(gm.)	10.23	8.66
P_2O_3	(gm.)	1.74	2.03
Total nitrogen	(gm.)	8.03	8.04
Urea nitrogen	(%)	79.6%	80.8%
Uric acid nitrogen	(%)	2.8%	1.9%
Creatinin nitrogen	(%)	4.7%	4.2%
Ammonia nitrogen	(%)	5.0%	5.1%
Residual nitrogen	(%)	7.9%	8.0%
Casts	(+)	9.0%	3.0%
Leucocytes (increased)		0.6%	1.0%

Although all the data were analyzed initially from the chronologic standpoint, only averages are reported here as the weekly and monthly averages failed to disclose any variations suggestive of significant trends.

The increased urine volume during pregnancy is well defined. It should not be forgotten, however, that another and special channel of water elimination is developed in the postpartum period, and that the fluid output from these two sources definitely exceeds that from the kidneys antepartum. The specific gravity shows a slight upward tendency after delivery, conditioning a partial compensation for the smaller volume. General elimination is ample throughout. Albumin as recorded

implies only very slight traces at the borderline of detection by both the heat and acetic acid, and the cold nitric acid contact tests. There is an almost equal incidence postpartum. Sugar (glucose) was demonstrated in over one-third of the urines examined antepartum, and lactose was present in two-fifths of those of the second period. The first value is materially higher than the usual record. The whole question has already been discussed at length elsewhere[2-6]; intermittent glycosuria is probably a feature of the majority of pregnancies and comes more frequently in record where consecutive studies are made on the individual. In only 18 per cent of the patients in this series did it recur with any degree of frequency and many of these demonstrated repeated aglycosuric intervals. Prior to the last week antepartum, when it is well known that lactose begins to appear, the sugar was proved to be glucose. The patients were not diabetic. Discussion of this question can find no place in the present report; the facts are recorded. ''Increased'' indican appeared in an appreciable number of urines both ante- and postpartum though nearly twice as frequently in the latter period. The significance is not great and is chiefly an index of the care given to the bowels. ''Urobilinogen'' is reported as it has been demonstrated by me[7] that in the urine of pituitary cases there is frequently found a substance that responds positively to the Ehrlich reagent.[8] With the present-day tendency to regard pituitary activity as a dominant factor in the regulation of pregnancy, this figure is of interest. The positive cases recorded showed no more than traces, and these only in urines of the last ten days antepartum. The frequency of occurrence in established pituitary cases ranges from 21 per cent in bilobar failure to 71 per cent in hyperactivity of both lobes.[9] The figures from the pregnant urines are not impressive as suggesting any marked overactivity of the hypophysis.

The acid elimination, calculated from the titratable acidity plus the acid equivalent of the ammonia excretion, is practically constant throughout and within the conventional normal range. The chloride elimination (arbitrarily reported as NaCl as a rough measure of fixed alkali output) antepartum is normal and falls off in the second period. Some chloride, however, is eliminated in the milk though not enough to account for the difference. The total nitrogen fortuitously shows the same level in both periods, both being above a maintenance level. That protein storage occurs antepartum is well known, and, in the period following delivery, the breast milk accounts for a nitrogen elimination of significant proportions. Urea nitrogen shows the recognized depression antepartum, which, however, is also observed in the second period as well. Uric acid is absolutely high and falls after confinement. The ammonia in both periods is relatively high though yet within the normal range. There is a slight falling off of the creatinin output in the postpartum interval for which the milk content[10] fails to

account. The residual nitrogen values exhibit an upward trend but are within the conventional limits of normal variation. This fraction even more than the ammonia seems to be responsible for the lower urea values, an observation not wholly in accord with the usual report. The transformation of urea to ammonia after voiding may be a factor here.

The report of casts rests upon the observation of an occasional hyaline cylinder; in a few instances, an increase of leucocytes was observed in the sediments of urines voided within a few days prior to delivery.

Broadly speaking, the albumin, sugar, volume, and the urea and uric acid nitrogen percentages are the only data departing materially from the accepted norms, and, even here, the degree of the divergence is variable.

3. *Blood Chemistry.*—As the urine derives from the blood, examination of the amounts of the constituents of the latter are of basic interest. It must not be ignored, however, that the urine is an end-result of the summation of a progression of variables and insusceptible of significant change after it enters the bladder. The blood, on the other hand, is under the constant influence of a large number of regulating mechanisms of which elimination by the kidneys is one, and that these operate to maintain a constancy of composition for which the urine has no equivalent mechanism. With urea nitrogen forming from 40 to 50 per cent of the blood nonprotein nitrogen, it constitutes more nearly 85 per cent in the urine partition. An even more striking lack of correlation is shown by the residual fractions, but the composite character of these moieties make this the less significant.

TABLE V. BLOOD CHEMISTRY

	PARTUM	
	ANTE-	POST-
Nonprotein nitrogen (mg.)	25.0	32.0
Urea nitrogen (mg.)	12.0	16.0
Urea nitrogen (% of NPN)	48%	50%
Uric acid	3.3	3.7
Creatinin	1.5	1.5
Residual nitrogen	11.3	14.2
Sugar	83.0	94.0
Cholesterol	177.0	157.0

Of the large number of known constituents of the blood for which exist reliable quantitative methods of estimation, but a few have been studied. This has been conditioned, as have the other compromises in this study, by the basic necessity of maintaining the continuous cooperation of the individual patient. Repeated venipuncture alone has depleted materially the tale of those starting as subjects of this study, and had a fear of exsanguination arisen in the minds of the faithful, the number of completed cases would have been still further dimin-

ished. It is unnecessary to dwell on this topic; those who have attempted continuous studies will appreciate the cogency of the reasons.

The data secured are given in Table V. Again only averages are presented as in the main the detailed analysis failed to uncover suggestive trends.

The lowered value for nonprotein nitrogen so frequently recorded by others is again remarked in this series. A prompt return to more normal levels characterizes the postpartum observations.

The urea figures show the same general relationship, but the lower antepartum values are yet a larger part of the total nonprotein nitrogen than is the report from certain other sources.[11] No patent explanation of the contradiction is forthcoming; the matter has already been discussed elsewhere in detail.[2-d, 11]

Most recently, through the courtesy of my associate, Dr. R. S. Hunt, a series of independent observations has been made, and the average value of these (nonprotein nitrogen 27 mg.; urea nitrogen 12 mg. or 44.4 per cent) compares satisfactorily with the values here recorded.

Uric acid was determined throughout by the Folin-Wu[12] procedure in order that the values should be mutually comparable. The two averages are normal, that antepartum being somewhat the lower. This is possibly interesting in connection with the fact earlier recorded, that the urine uric acid during the first period was 50 per cent greater than during the second where higher blood uric acid levels prevailed. The hydremia, well established as a feature of normal pregnancy, should account, in part at least, for all of the lower antepartum figures. The percentile differences of the several increments preclude the acceptance of this as the sole agent. Creatinin is normal throughout, a fact to be predicted from the relative invariability of this component. The antepartum residual nitrogen is frankly low, the usually accepted normal being 15 ± 2 mg. Parenthetically, this observation bears directly on the question of the blood urea percentage. In the present series, the data do not warrant the interpretation that the residual fraction is increased at the expense of the urea moiety. It increases to within the normal range after delivery. The low blood sugars antepartum, also by the earlier Folin-Wu[13] method, are still within the normal range. They are significant only in contrast to the higher value established after the termination of the pregnancy.

Blood cholesterol, as has been remarked by others, shows a real increase above normal levels in the antepartum period, especially if allowance be made for the hydremia, and recedes to the normal after delivery. This is one blood constituent that may show some slight time influence. In this series, about half of the cases showed a progressive upward trend, the remainder being divided equally between those exhibiting no difference and those showing a definite decline.

No attempt was made to secure sodium chloride values as this substance seems to show a relative invariability exceeded by but few of the blood components. It is to be regretted that studies could not be made on the other lipoids, the mineral constituents, and the acetone bodies. Certain of these will be made the subject of future investigations. Plass[14] and his associates, among others, have demonstrated the variations in the several protein fractions in a most comprehensive manner.

4. *Blood Morphology.*—No definite trends were disclosed by chronologic analysis, and consequently the data are presented as averages for the ante- and postpartum periods. The significant figures are collected in tabular form.

TABLE VI. BLOOD MORPHOLOGY

DATUM	PARTUM	
	ANTE-	POST-
Hemoglobin	66%	73%
Erythrocytes	4,140,000	4,380,000
Color Index	0.80	0.83
Leucocytes	9,680	7,910
Polymorphonuclear Neutrophiles	69%	59%
Lymphocytes	25%	34%
Endothelial Leucocytes	5%	5%
Eosinophiles	1%	2%

But few points require comment. The erythrocyte count shows a decline antepartum which is of the order of the blood dilution and may derive from this well established change. Hemoglobin, on the other hand, shows a definitely greater decrement, indicating an absolute lowering of the blood content of this essential constituent. The picture is one of a moderate secondary anemia with lowered color index.

The leucocytes are somewhat increased antepartum, the upward tendency gaining greater significance from the opposing influence of the hydremia. The differential formula is normal, the blood showing a leucoid (adult) type. After delivery, the leucocyte count falls to more average levels, chiefly at the expense of the neutrophilic elements. This conditions a relative increase in the lymphocyte group, thus determining a more lymphoid type of blood.

5. *Respiratory Metabolism.*—Deviations from the predicted normal basal rate have a very real diagnostic significance as the numerous publications in recent years bear witness. Further, it has been reported by a number of investigators that the basal rate increases during pregnancy by an amount well in excess of that conditioned by the weight increase. The number of individuals reported, however, with whom protracted continuous studies have been made, is small. In this, as in so many other fields of biology, a multiplication of coordi-

nated measurements is necessary to absorb individual differences and to define the normal zone with any real certainty. In the present study, three wholly independent series were carried out, computed separately, and the three curves of change thus defined, compared. The slopes were identical in the two extreme series, and practically so in the third which fell midway between them. The values with Series "A," from women who came for the test from their homes to the hospital, averaged 6 per cent higher than in Series "C," where the machine was carried to the patient in the bed in which she had slept, and who frequently was awakened from sleep to prepare for the measurement. The subjects in Series "B," whose curve defines the mean position, were moved from one to another room in the same building. It is felt that these differences in procedure may well explain the numerical differences in the rate. Incidentally, these several procedures define the extremes of practice. For the sake of convenience, the average values have been computed and reduced to tabular form. It will be understood that the two sets of limiting values are respectively 3 per cent above and below those given in Table VII. For possible convenience to the user, the figures postpartum are included. The comment on the first part of the curve is equally applicable to the second, with the exception that but one measurement was made on the patients in Series "A," and that immediately prior to their discharge from the hospital where they had been confined. The sharp drop in the rate showing a maximum depression between the third and fifth weeks postpartum with speedy restoration to a substantially normal level seems to be characteristic. All the deviations as recorded are the means of these indicated by the Harris-Benedict[5] and Aub-DuBois[6] predictions.

TABLE VII.   PROGRESSIVE CHANGE IN BASAL METABOLIC RATE

Weeks	24	21	18	15	12	9	6	3	0
A.P. Deviation	−8%	−6%	−5%	−3%	−1%	±0%	+2%	+3%	+5%
P.P.	–	–	−4%	−4%	−4%	−5%	−12%	−12%	–

TABLE VIII.   PHYSICAL DATA FROM BASAL RATE

DATUM	PARTUM	
	ANTE-	POST-
Pulse	78	67
Respiration	17	17
Temperature	98.1°	97.8°
Blood Pressure:		
Systolic	108	112
Diastolic	67	70

The curve is not carried beyond the beginning of the twenty-fourth week antepartum as the number of observations is too few to give confidence in the trend of the curve. It is seemingly rectilinear up to the

thirtieth week, and such an assumption, in the study of early cases, could not lead to gross error. The extrapolated magnitudes, further, are of the older of those recorded in a group of patients referred for diagnostic study (amenorrhea) and subsequently proved to be pregnant.

A basal rate report is wholly incomplete and may be seriously misleading which does not include the data on pulse and respiration rates, body temperatures, and blood pressures recorded at the time of the basal measurement. Those resulting from this investigation are collected as averages in Table VIII.

The pulse rates before delivery are somewhat high; they sink to normal in the postpartum interval. The respiration frequencies are unchanged. The temperature is 0.3° higher antepartum than that after
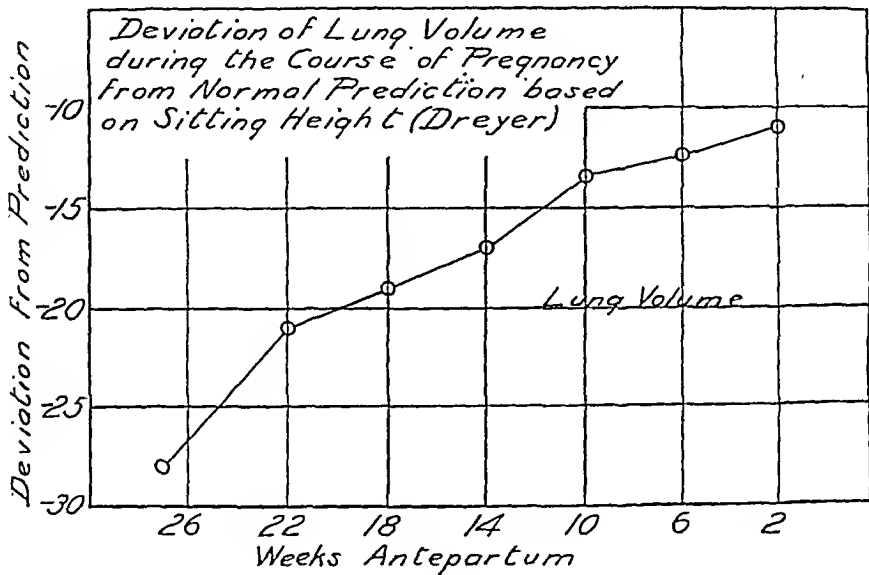
Fig. 1.

confinement. Pregnancy normally produces a lowering of the blood pressure; this exhibits an upward tendency postpartum, but, within the time limits of this study, fails to reach the conventional normal level.

6. *Vital Capacity.*—This datum, usually so designated, but more properly reported as Lung Volume as it represents the maximum amount of air that can be expelled after deep inspiration, is peculiarly susceptible to the degree of the patient's cooperation. That it shows a progressive upward tendency during pregnancy has already been recorded, and that in spite of the fact that the growing uterus would seem to exercise an opposing influence tending to determine a decrement. The present figures are wholly confirmatory. As the absolute value depends upon the size of the individual, relative values have a more general application. Using the Dreyer[3] correlation with sitting

height (those with weight and with chest girth are independable for present purposes), the variations observed may most easily be presented in graphic form.

While the increment is continuous, in this series at least, the coefficient of increase falls off in the last ten weeks. Further, as compared with the far from exacting standard of Dreyer's "B" Class, at no time do the patients reach the level of prediction. The influence on this test of the degree of cooperation is undoubtedly one subversive factor. The figures may be regarded as typical for the group here represented.

7. *Alveolar Carbon Dioxide.*—It has been a recognized fact for some time that the tensions of the alveolar carbon dioxide are depressed to levels ordinarily associated with acidosis. The present data offer no exception to this generalization. They can be presented most simply in graphic form.
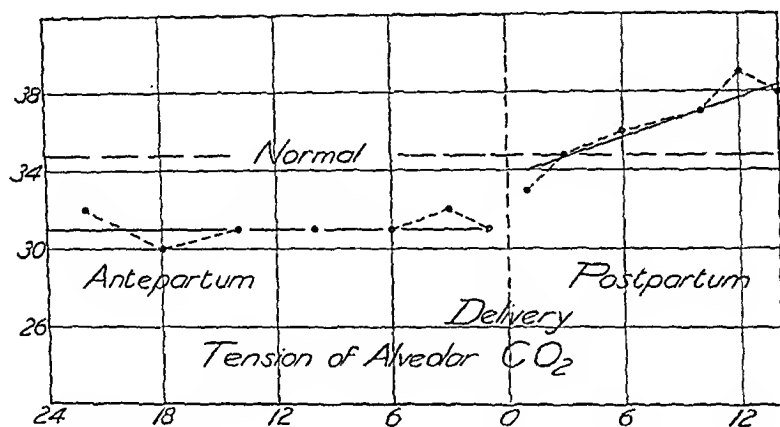
Fig. 2.—Tensions of alveolar carbon dioxide (arterial) in millimeters of mercury both ante- and postpartum.*

8. *Galactose Tolerance.*—During the past few years, I have published a series of papers on certain phases of the metabolism of galactose.[15] Briefly, it may be stated that during the prepuberal period an oral dose of 20 gm. of this sugar will produce a brief, slight galactosuria, while a 10-gm. test meal yields wholly negative results. With the onset of menstruation, the assimilation limit rises, and in the course of a year or even less attains the adult level of 40 gm., which persists to the menopause, and possibly beyond. Exception to this is found in pregnancy where, following conception, the assimilation limit falls and ultimately, at some time prior to delivery, uniformly reaches the prepuberal level of 20 gm. For a short time (2 weeks or less) after confinement, there is a further decline to 10 gm., probably conditioned by the synthetic activity of the mammary glands, and then the tolerance rises steadily so that usually at the end of six months it is re-

stored to the normal adult level of 40 gm., even though the woman may still be lactating. The results of repeated tests on this series are given in Table IX.

TABLE IX. GALACTOSE TOLERANCE

PERIOD (MONTHS)	TOLERANCE LEVEL		
	20 GM.	30 GM.	40 GM.
3	67%	33%	0
4	67%	33%	0
5	63%	37%	0
6	67%	33%	0
7	62%	38%	0
8	89%	11%	0
9	100%	0	0
Delivery			
1*	100%	0	0
2	73%	27%	0
3	100%	0	0
4	67%	33%	0
5	25%	75%	0
6	0	50%	50%
Over 6	0	0	100%

*Third and fourth weeks only.

But little comment is necessary. Patently, as early as the third month the majority of the cases show a tolerance depressed to the terminal level. This proportion continues through the greater part of the antepartum period, and only at the very end is the lowest figure (20 gm.) shown uniformly by all. Similarly, after delivery there is a gradual rise, scarcely of significant proportions during the first three months, but increasing steadily thereafter so that in this series, after six months have elapsed, all have returned to the normal adult level, irrespective of the mammary status. The figures of Table IX define criteria for normal performance with such definition as the test allows.

Certain other special observations were made with this series, but they have been, or will be, discussed elsewhere and are not an integral part of the present investigation.

The data given here define representative values for a variety of objective measurements in normal pregnancy. Many are in close agreement with similar data derived from the study of women in a state of sexual rest; other manifest what can only be interpreted as changes incident to the special physiologic status. Combined, they define normal criteria for use in the study of disease conditions which may be engendered or complicated by pregnancy.

REFERENCES

No attempt has been made to review the somewhat extensive literature in this field. References to the author's work are purely expository. The remaining few citations are for purposes of documentation.

(1) Collected papers from the Evans Memorial, No. 1, Endocrine Studies, Boston, 1930. (2) (a) *Rowe, Banks, and Alcott:* Am. J. Physiol. 71: 660, 1925. (b) *Rowe, Alcott, and Mortimer:* Ibid. 71: 667, 1925. (c) *Rowe:* J. Lab. & Clin. Med. (in press). (d) *Rowe, Gallivan, and Matthews:* Am. J. Physiol. 95: 592, 1930. (e) *Rowe, Gallivan, and Matthews:* Am. J. Physiol. 96: 94, 1931. (f) *Rowe, Gallivan, and Matthews:* Am. J. Physiol. 96: 101, 1931. (g) *Rowe:* Am. J. Physiol. 96: 112, 1931. (h) *Rowe:* (In press, Proc. Soc. Exp. Biol. & Med.) (3) *Dreyer:* The Assessment of Physical Fitness, New York, 1921, Hoeber. (4) *Rowe:* Am. J. Physiol. 72: 436, 1925. (5) *Harris and Benedict:* Carn. Inst. of Wash. Publ., No. 279, 1919. (6) *duBois and Aub:* Arch. Int. Med. 19: 823, 1917. (7) *Rowe:* Bost. M. & S. J. 191: 151, 1924. (8) *Ehrlich:* Med. Wchnschr. 2: 151, 1901. (9) *Rowe and Lawrence:* Endocrin. 12: 245, 1928. (10) *Denis, Talbot, and Minot:* J. Biol. Chem. 39: 47, 1919. (11) *Stander:* The Toxaemias of Pregnancy, Williams and Wilkins, Baltimore, 1929 for brief discussion and bibliography. (12) *Folin and Wu:* J. Biol. Chem. 54: 153, 1922. (13) *Folin and Wu:* J. Biol. Chem. 41: 367, 1920. (14) (a) *Plass and Bogert:* J. Biol. Chem. 59: xxiv, 1924. (b) *Idem:* Bull. Johns Hopkins Hosp. 35: 361, 1924. (c) *Plass:* Bull. Johns Hopkins Hosp. 35: 345, 1924. (d) *Plass and Matthew:* Proc. Soc. Exper. Biol. & Med. 24: 215, 1926. (e) *Plass and Rourke:* J. Lab. & Clin. Med. 12: 735, 1927. (15) *Rowe:* J. A. M. A. 89: 1403, 1927, for condensed summary; AM. J. OBST. & GYNEC. 17: 351, 1929.

Devraigne, Sauphar, and Mayer: Treatment of Puerperal Infection With Intravenous Injections of Aseptic Pus: Bull. Soc. d'obst. et de Gynée. 18: 459, 1929.

The authors have injected aseptic pus intravenously in cases of puerperal sepsis, and maintain there is no danger in this procedure. They have never observed embolism or anaphylaxis. The utilization of aseptic pus for postpartum and post-abortal infections is not new but the intravenous route is a new departure. The latter method is more rapid, more energetic, and more efficacious. The procedure may be employed prophylactically with great benefit. The action of aseptic pus is purely transitory and all it does is to add deficient ferments. Hence the treatment must be continued for a long time with regularity not only until all local and general signs and symptoms have disappeared but even afterward. With this treatment other forms of therapy should be combined. In very severe cases the value of this form of treatment is enhanced by the production of a fixation abscess.

J. P. GREENHILL.

EFFECTS OF EXPERIMENTAL TORSION OF UTERUS ON THE VESSELS OF PARAMETRIUM AND CONTIGUOUS TISSUES

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CLINICALLY it is well known, that patients with a history of infection during the puerperium show marked pelvic varicosities. This can be explained by the end-results of an exudate which nature has healed by the formation of scar tissue. The arteries are shrunk, the venous circulation is interfered with and hence dilatation of veins occurs.
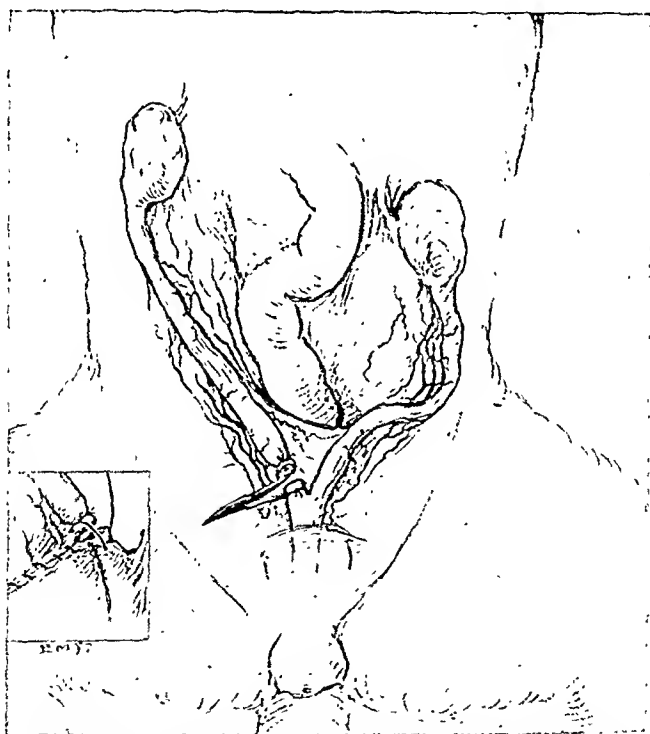
Fig. 1.—Showing removal of section of right uterus and broad ligament in a dog.

Patients with a grossly negative pelvis giving a history of a previous pelvic inflammation complaining of pain in lower abdomen frequently show pelvic varicosities. The second group presenting this picture is comprised of cases with uterine displacements, tumors, lacerations, and pregnancy. The contributing factors in this latter series are merely pressure, torsion or interference with the return (venous) circulation, hence dilatation results. The pelvic vessels become more readily dilated because of the anatomical absence of valves.

With the clinical view in mind, that infection is not the only cause for pelvic varicosities, we have attempted to prove experimentally that displacement or torsion of uterus thereby interfering with the return flow must be considered as factors. For this purpose the following experiments were performed on dogs. Anatomically dogs have a bicornuate uterus fusing in the lower portion.

With the strictest surgical asepsis and antisepsis a section of the right uterus close to the fusion was taken with some of the broad ligament. The edges were approximated with catgut and hemorrhage controlled. The corresponding uterus
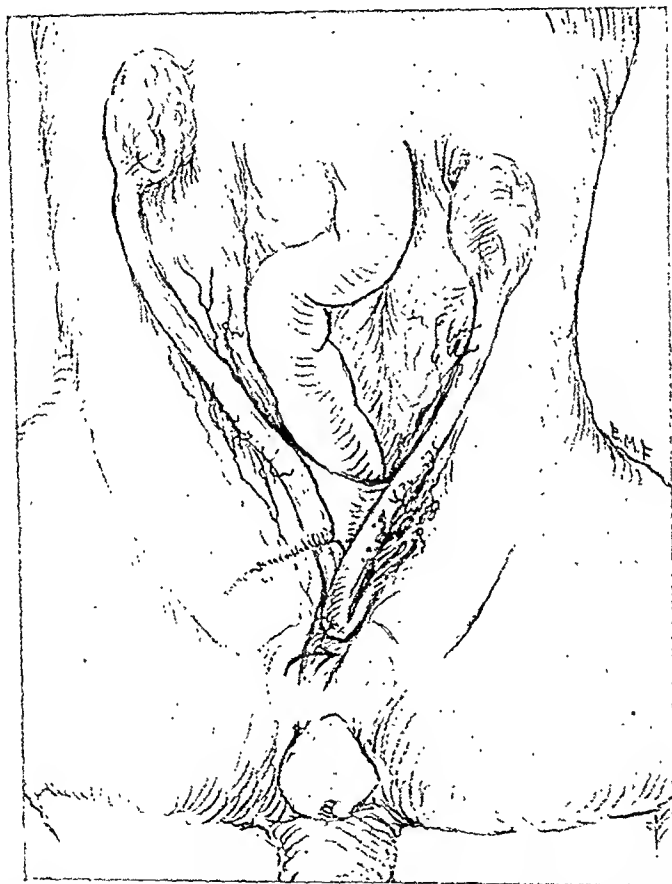
Fig. 2.—Showing left uterus sutured to fused segment and entire structure twisted to left side.

was then bent and sutured to the fused segment and the entire structure was therefore twisted to the left side. About three weeks later another celiotomy was performed and it was grossly observed that the twisted portion was markedly hypertrophied and numerous varicosities were present in the broad ligament. A partial hysterectomy was done and sections were made through the uterus and adjoining broad ligament corresponding to the sectioned right uterus removed on previous operation. The following were the microscopic findings on both sections:

Section through uterus on right side (untorsioned). The endometrial surface is smooth consisting of a single layer of columnar epithelium. These cells contain a moderate amount of cytoplasm and a nucleus which is pycnotic. Just beneath the endometrial lining areas of recent hemorrhage are frequently encountered. The

stroma is composed of low connective tissue in which are present a moderate number of oval cells with an occasional small mononuclear lymphocyte. The gland spaces are of the simple tubular variety. They are moderate in number and lined by a single layer of columnar epithelium that is actively secreting. The nutrient vessels in the stroma are congested. The inner circular muscle coat is well defined. The
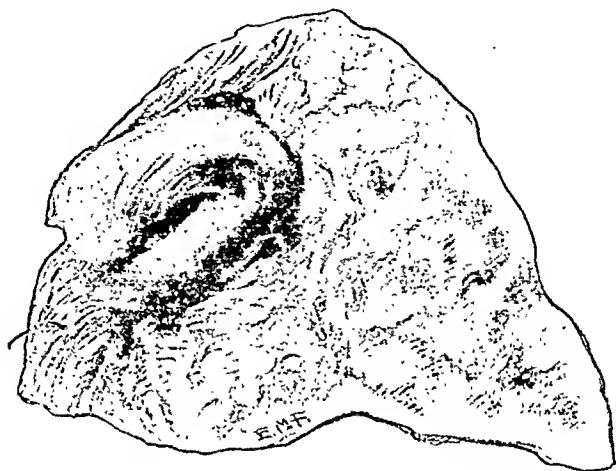
Fig. 3.—Showing segment of torsioned uterus and broad ligament. (Anterior view.)
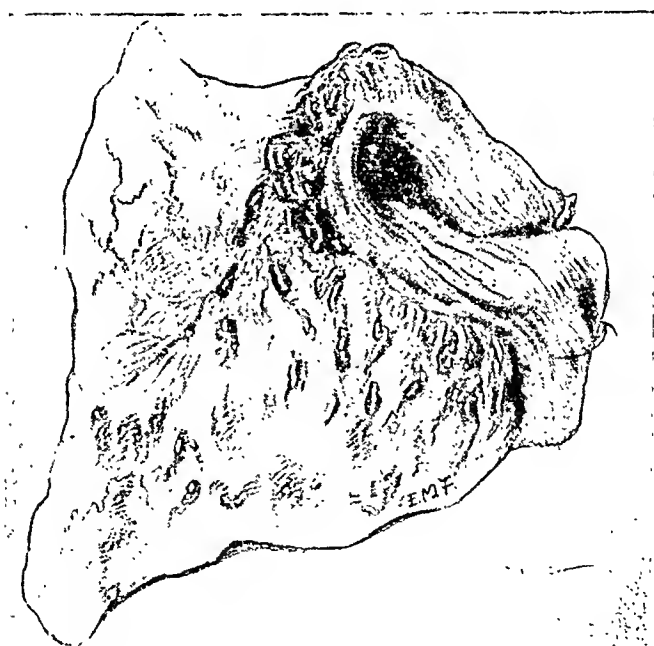
Fig. 4.—Showing segment of torsioned uterus and broad ligament. (Anterior view.)

muscle cells are spindle shaped, containing an oval vesicular nucleus. The blood vessels just beneath this layer are numerous and congested. The outer longitudinal muscular coat is well defined. The serosa apparently normal.

Section through the parametrium reveals numerous, large vessels which are congested, suspended in loose connective tissue in which occasional small mononuclear lymphocytes are seen.

Section through the torsioned uterus reveals a marked increase in the size of the uterine cavity. The lining epithelium is gyrated, consisting of hypertrophied and hyperplastic columnar epithelium. An occasional tubular gland is encountered. It is lined by columnar epithelium. The endometrial stroma is thinned out, com-

Fig. 5.—Low power section of normal uterus.
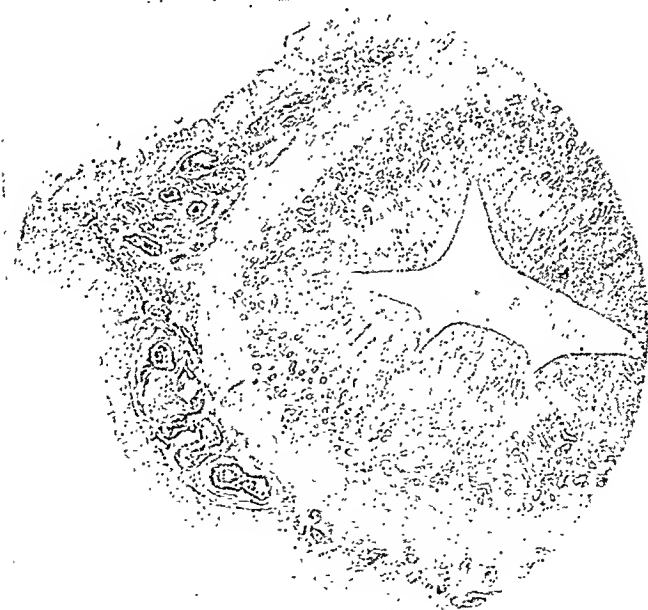
Fig. 6.—Low power section of torsioned uterus.

posed of connective tissue and small spindle cells. The blood vessels here are numerous and markedly engorged with blood. The inner circular mucosa is markedly hypertrophied and hyperplastic. The individual cell is larger and the nucleus takes

a slightly deeper stain. Numerous congested blood sinuses are present within this coat. The blood vessels situated between the inner circular and the outer longitudinal muscle layers are increased in number and size and all are engorged with
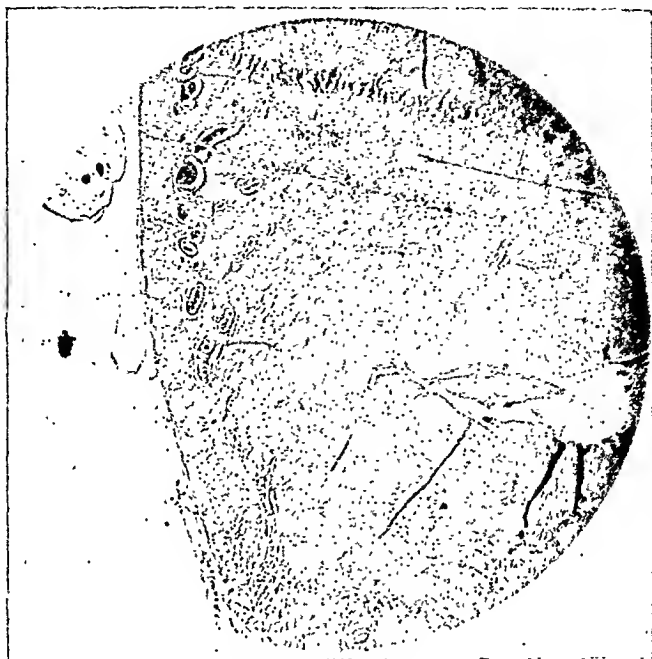
Fig. 7.—Section of normal uterus, elastic tissue stain.
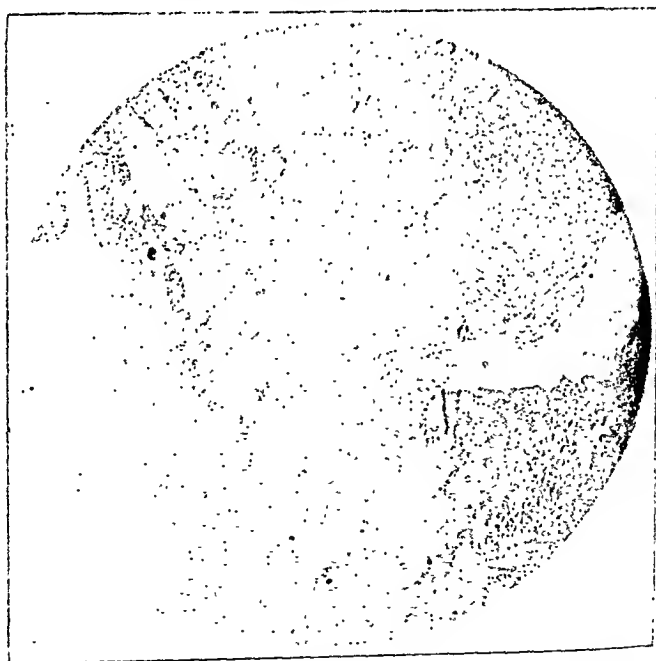
Fig. 8.—Section of torsioned uterus, elastic tissue stain.

blood. The outer longitudinal coat too is hypertrophied and hyperplastic. The serosa is slightly edematous.

Section through the parametrium reveals a marked increase in the size of the blood vessels and the congestion here too is very marked.

The characteristic findings with the Weigert stain reveal an increased amount of elastic tissue in all the coats of the uterus as well as in the arterioles and arteries. The stain is heavier and the fibers are thicker.

Fig. 9.—Low power section of broad ligament, normal side.

Fig. 10.—Low power section of broad ligament, torsioned side.

SUMMARY

Sections of the torsioned side revealed a marked hyperplasia and hypertrophy of all the several coats of the uterus, i.e., endometrial,

muscular and serous. There was a marked increase in the number and of the blood vessels. There was also an actual increase in the elastic tissue ratio of the blood vessels while the connective tissue ratio of the entire organ was grossly increased.

CONCLUSION

The above experiments show clearly that displacement of uterus causes an increase in size of organ, and in the number and size of blood vessels. The apparent interference of return circulation being the chief factor. Clinically, fibroids, ovarian cysts, pregnancy, uterine displacements, and lacerations, all predispose to pelvic varicosities. Hence interference in the venous flow in the pelvis will cause varicosities in the absence of infection.

Ferrari and Houel: Subtotal Abdominal Hysterectomy and Venous Ligation in Puerperal Infection. Arch. franco-belges de chir. 30: 1, 1927.

In many cases of puerperal infection operative interference is indicated. The authors favor the abdominal route because it permits more accurate palpation of the pelvic veins, better hemostasis, and the time consumed by the operation is shortened. They feel that in the majority of these cases subtotal hysterectomy is a better procedure than removal of the entire uterus. Occasionally where there has been a low implantation of the placenta or where the cervix is frankly infected the latter method may be the procedure of choice.

Subtotal hysterectomy and venous ligation are indicated where there are, despite medical treatment, persistent signs of puerperal infection. However, blood cultures must be negative, the test being repeated at least three times before operation is undertaken. The pathology present may be either multiple small abscesses of the uterine wall or an infected thrombophlebitis of the pelvic veins. The thrombosed veins may be felt as cord-like structures in the base of the broad ligaments. The clinical onset of thrombophlebitis may be following a mild uterine infection which may pass unnoticed or clear up rapidly under medical treatment; again it may occur following more pronounced uterine infection which clears up only with difficulty; or finally it may be associated with a frank uterine infection which persists despite treatment. In the first instance ligation of the veins is sufficient, and hysterectomy is not indicated; in the second it is questionable whether or not hysterectomy should be carried out; while in the third both hysterectomy and venous ligation are indicated.

These authors have operated upon 7 patients. In 2 cases hysterectomy and ligation of the common iliac veins was carried out, in 1 the inferior vena cava ligated, while in 4 cases the inferior vena cava and the utero-ovarian veins were ligated. Of the 7 cases, 5 recovered.

THEODORE W. ADAMS.

TORSION OF UNDISEASED UTERINE ADNEXA IN VIRGINS

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THE purpose of this paper is to consider the twisting of oviducts and ovaries which are otherwise normal without other coexisting pelvic pathology. In order to eliminate all reasonable possibility of inflammation it is deemed advisable not to include those cases in which the condition has occurred beyond the age of sixteen years. It must be realized that coitus introduces the possibility of pelvic infection, and there is no assurance of virginity beyond this age. Perhaps we should have limited our consideration of cases to those who had not reached puberty, because occasionally the state of virginity is terminated soon after. On the maternity services of two Detroit hospitals 94 girls sixteen years of age or under were delivered in one year (1929) and one of the patients was only eleven years old. During this same period of time (one year) the records of the Juvenile Court of Detroit show that of the 1886 girls sixteen years of age or under examined, only 566 or 30 per cent had intact hymens. Schied[1] in 1922 reported having operated upon a fifteen-year-old patient with pyosalpingitis and another, thirteen years old, with chronic active salpingitis. Gonorrheal vulvovaginitis in children and young girls is a common disease. Married women could not be considered, even if there were not the element of pregnancy, because the assurance of normal oviducts in this group is still more remote.

The twisting of previously diseased tubes and ovaries is not an uncommon occurrence. That complicating hydrosalpinx and ovarian tumors occurs most frequently. However, upon eliminating all reasonable possibility of previous pathologic conditions, the number of reported cases is found to be very small. A careful search of the literature reveals only six cases of twisted otherwise normal fallopian tubes. These have been reported by Schwartz,[2] Koster,[3] Hansen,[4] Rogers,[5] Darner,[6] and Gabe,[7] in girls sixteen, sixteen, fourteen, sixteen, thirteen, and fifteen years of age respectively. Two cases of torsion of a normal ovary have been reported by Johannsons[8] and Rost,[9] in patients six years and four months old. Ten cases of torsion of both tube and ovary without other pathology could be found reported by the following authors: Wachtel[10] (2 cases), Neugebauer,[11] Smith and Butler,[12] Auvray,[13] Cassidy and Norbury,[14] Munroe[15] (2 cases), Scheid,[16] and Fiolle.[17] The respective ages of these patients were four, sixteen, six, nine, eleven, fourteen, ten, eleven, thirteen, and ten years. Perhaps one of the cases reported by Munroe should not have been admitted because the mass was described as being the size of a lemon or small orange and suggests other pathology. Other articles are worthy of mention.

Anspach[18] collected and reviewed over 80 cases of twisted tubes, both normal and pathologic, mostly in multiparous women, but 13 were classified as virgins. He also quoted Heil as having operated upon a patient with twisted "normal" tube, but there was a dermoid cyst of the ovary. Cohen[19] described a case of twisted tube and ovary in a girl of thirteen years of age but the mass was so large that ovarian tumor was suspected and this was not ruled out by pathologic examination. Schwartz[2] described an additional case in a patient twenty-two years old. Vigholt[20] contributed a case of tubal torsion in a seventeen-year-old girl who was probably a virgin. Norris[21] reported a case of twisted normal ovary in a nineteen-year-old virgin. Reuder's[22] article described three cases of twisted normal tubes in alleged virgins between the ages of twenty and twenty-two. Smith and Butler[12] abstracted the records of 24 previously reported cases of torsion of ovarian tumors in patients between the ages of two and fourteen years and while this is somewhat beside the subject which we are considering, it is interesting because of the age incidence. Haultain[23] reported a case but the age was not given. Bauer[24] described a twisted ovary in a thirty-year-old married woman. Gillies[25] mentioned a case of twisted tube in a single girl twenty-three years old and Jefferson[26] another in a single
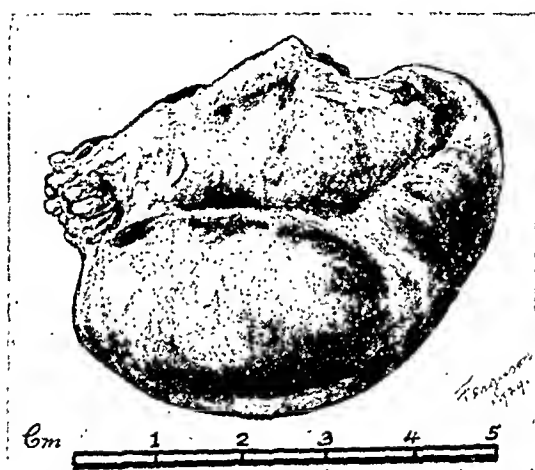
Fig. 1.—Drawing of specimen removed.

woman thirty-two years of age. Koster[3] found in the literature eleven cases of torsion of normal tube in nulliparous women, but some were married and others were beyond the age requirements of this paper. Caraven[27] reviewed the literature on this subject in 1927 and included a case reported by Hussy in 1922 and another seen by Racher and Jeanneney and reported by Auvray in 1926. In these cases the adnexa were presumably normal otherwise.

CASE REPORTS

CASE 1.—(No. H-2631.) A girl, aged seven, had always enjoyed good health until twenty-four hours before she was admitted to the Clinic complaining of severe left lower abdominal pain. The trouble had begun quite suddenly the previous morning with upper abdominal pain which radiated to the left lower abdomen. She became nauseated and vomited several times during the day and during the night and early next morning the pain localized in the lower left abdomen. The pain was constant and at times quite spasmodic. The bowels had been regular and there had been no urinary symptoms. Physical examination showed a patient in considerable distress, crying at times with pain. The temperature was 98.6° F. and the pulse was 90 per minute. The heart and lungs were normal. The abdomen was not distended and the wall was flaccid. There was extreme tenderness over

the left lower quadrant with some left rectus rigidity on pressure. Laboratory examination was as follows: Hemoglobin 90 per cent, W.B.C. 13,000 with 78 per cent polymorphonuclears and 22 per cent lymphocytes. The uranalysis was negative for albumin and sugar. Laparotomy was performed through a four-inch low right rectus incision. On opening the abdominal cavity bloody fluid was found. Exploration of the appendix showed it to be quite normal with a few peri-appendiceal congenital bands. Exploration for Meckel's diverticulum was negative. Examination of the pelvis revealed a tumor about the size of a hen's egg which consisted of the distal one-third of the left tube and left ovary. The mass was black and strangulated, due to the pedicle being twisted. There were five complete turns. The uterus, right tube, and right ovary were normal. Upon untwisting the pedicle the circulation did not return and removal of the ovary and distal half of the tube was necessary. Appendectomy was performed and the abdomen closed. The patient made an uneventful recovery.

Fig. 2.—Deformity of oviduct tissue due to hemorrhage.

PATHOLOGIC REPORT

Gross Examination.—The specimen is a kidney-shaped piece of tissue, bluish black in color, uniformly firm in consistency, measuring 6.5 cm. from pole to pole and 4.5 cm. in greatest diameter. The surface is slightly irregular in outline, but smooth and glistening without evidence of rupture. The major portion of the mass is composed of a markedly enlarged ovary to which, in the "hilus" position, lies the distal two-thirds of the fallopian tube measuring 4 cm. in length and 1.4 cm. in diameter. The fimbriae are present but markedly swollen and discolored. The greatest length of the ovary is 6.5 cm. and the greatest diameter 3.1 cm.

Microscopic Examination.—In the sections of ovary the picture is that of marked hemorrhagic extravasation which almost completely destroys the normal tissue structure. Occasionally a markedly dilated vessel can be seen. The tunica and a narrow underlying zone of cortex show evidence of pressure atrophy and stretching and constitute the only recognizable ovarian tissue remaining. The hemorrhage has evidently taken place chiefly in the central portion and by pushing the cortex

outward has formed a sac containing partially laked blood in which there is very little fixed tissue. In the oviduct the hemorrhage has not been as severe and the normal architecture is still recognizable. There is marked deformity, however, due to flooding of the tissue with blood. Very little of the discoloration is due to necrosis. There is no evidence in any of the sections examined of newgrowth tissue or inflammatory reaction.

ETIOLOGY

In consideration of the causes of tuboovarian torsion, attention has been called to the fact that the tube and ovary are extremely mobile organs, and a normal tube has a twist of 90° (Darner[6]). The peristaltic action of the surrounding intestines has been blamed as well as the changes in the intraabdominal pressure due to coughing, defecation, hiccoughing, or trauma to the abdomen (Heil[28]). In Rost's[9] case the child had suffered from marked constipation since birth, evacuation
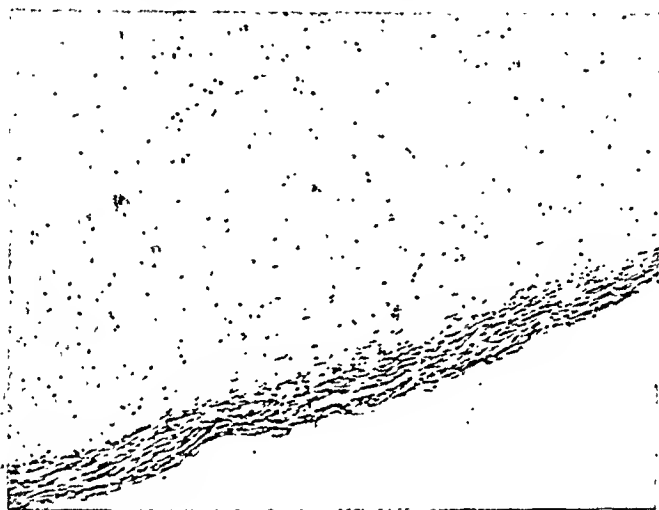
Fig. 3.—Extensive hemorrhage in ovary causing expansion and stretching of tunica and cortex.

being accomplished only after considerable straining, suggesting the possibility of intraabdominal compression. Constipation also produces pelvic congestion. Muscular strain in gymnastic exercise has been mentioned in explanation of the etiology. A long mesosalpinx probably contributes to the ease with which twisting can occur and Thorek[29] has called attention to the tortuosity of vessels in the mesentery, suggesting that the unequal pressure in the arteries and veins might cause twisting. Payr[30] experimentally produced torsion of the splenic pedicle by altering the venous pressure. Sellheim[31] has advanced the rotation theory by which visceral torsion is attributed to habitual body motion or sudden external violence. Moehring[32] states that there is both the torsion which takes place suddenly and chronic rotation which takes a slow course.

Anspach and Norris attach the greatest importance to vulvovaginitis in childhood, flaring up in adolescence and producing an unrecognized early hydrosalpinx,

the tube being only apparently normal.   Brown[33] reported a case of severe wide-spread exudative peritonitis occurring in a child five years old two weeks after a severe vulvitis.   From the peritoneal exudate Streptococcus hemolyticus was recovered.   The tubes were about one and one-half normal size and were apparently the source of the peritonitis, the infection having extended up through the uterus. Severe hemorrhage into the tube would destroy the histopathologic values at the time of examination of the surgical material, rendering a definite statement as to inflammation impossible.   Anspach also cites cases of oviduct infection following exanthematous diseases.   His case of twisted oviduct in a fourteen-year-old virgin showed salpingitis on pathologic examination.   Thorek[29] described a case in which the patient, fourteen years of age, had had an attack of measles and whooping cough two years previously with abdominal pain at that time.   The pathologic diagnosis was chronic appendicitis and salpingitis and cystic ovary.

The right side is more frequently involved.   Gabe[7] called attention to the right pelvic cavity being larger than the left, due to encroachment of the sigmoid on
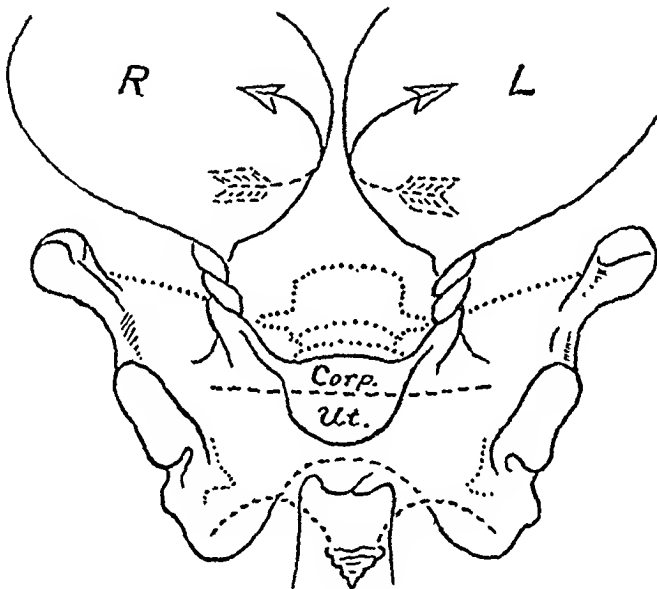
Fig. 4.—Diagram illustrating Küstner's Law.   From Küstner's original article.

the left, and as a result, greater movement of the contents of the right half being possible.   Besides, he states that peristaltic movement is greater in the cecum and ileum on the right than in the sigmoid.   Thorek[29] also mentions the possibility of chronic appendicitis and resulting adhesions in the right pelvis.

Küstner's law is frequently referred to.   This law, which deals with the direction in which ovarian tumors twist when torsion occurs, was stated by Küstner[34] in 1891, as follows: " . . . usually the pedicle of the tumor on the left side is twisted in one direction and a tumor on the right side in the other direction; and indeed the pedicle of the left tumor is usually rotated in a spiral to the right and the pedicle of the right tumor is rotated in a spiral toward the left."   The law is usually accepted as applying to normal uterine adnexa as well as tumors.   The drawing accompanying Küstner's original article (Fig. 4) shows that in applying the law it is necessary that the observer stand with the pedicle pointing toward him, and he must also understand that the direction of rotation is expressed in terms of his right or left side and not the patient's.   It seems as though Küstner's observation could be more concisely stated as follows: *In torsion of uterine adnexa twisting on the right side is clockwise and on the left side, counter-clockwise, when*

the pedicle points away from the observer. This is the position in which the surgeon would be most likely to observe such pathology. Judging from the reported cases, Küstner's law is usually followed, and was in our case. However, Schwarzwaller's[35] case was an exception and there have probably been others. As far as we have been able to ascertain there were more complete turns in our case than in any previously reported.

This condition occurs much more frequently on the right side, which makes the differential diagnosis between appendicitis or, in adults, tubal pregnancy, almost impossible.

CONCLUSIONS

1. An instance of torsion of the adnexa in a seven-year-old girl is herewith reported. This case is especially rare because the left adnexa were involved, whereas in nearly all of the cases previously reported the phenomenon occurred on the right side. There was apparently no previous disease of the tuboovarian tissue.

2. A careful review of the literature reveals only eighteen authentic cases of torsion of the tube or ovary or both in supposed virgins and with reasonable assurance that previous or coexisting pelvic pathology was absent.

3. It is never possible, however, to state with complete assurance that the adnexa were normal before twisting because the extensive hemorrhage, necrosis and infarction which follow twisting would obliterate evidence of mild inflammation which might be present.

4. The nineteen cases (including the present one) which have been reported, fall in the following age distribution: one at four months, one at four years, and two at six, one at nine two at ten, one at eleven, two at thirteen, two at fourteen, one at fifteen, and four at sixteen years.

5. The maximum age limit of virginity was set at sixteen years, in order to exclude all possibility of venereal infection. This is doubtless too high and perhaps this review should have admitted only those cases where the condition occurred before puberty. Setting the age limit at thirteen years instead of sixteen would have reduced the number of reported cases from eighteen to eleven, eight of both ovary and tube, two of ovary, and only one of torsion of the oviduct.

6. Twisting invariably occurs from right to left on the right side and from left to right on the left side.

7. Because of the rarity of the condition, a correct preoperative diagnosis would be almost impossible.

8. On account of the more frequent right-sided involvement, the incorrect diagnosis of appendicitis would usually be made.

REFERENCES

(1) *Scheid, F.:* Med. Klin. 18: 1277, 1922. (2) *Schwartz, J.:* Zentralbl. f. Gynäk. 46: 1959, 1922. (3) *Koster, H.:* Am. J. Surg. 7: 67, 1929. (4) *Hansen, A.:* Zentralbl. f. Gynäk. 46: 707, 1922. (5) *Rogers, L.:* Brit. M. J. 1: 778, 1925.

(6) *Darner, H. L.:* Am. J. Obst. & Gynec. 11: 368, 1926. (7) *Gabe, W. E.:* Arch. Surg. 18: 1305, 1929. (8) *Johannson:* Nord. Med. Ark. (original article not read). (9) *Rost, W. L.:* Arc. Pediat. 40: 787, 1923. (10) *Wachtel, M.:* Zentralbl. f. Gynäk. 52: 1453, 1928. (11) *Neugebauer, F.:* Zentralbl. f. Gynäk. 46: 1961, 1922. (12) *Smith, R. R., and Butler, W. J.:* Am. J. Obst. & Gynec. 2: 507, 1921. (13) *Auvray:* Bull. soc. d'Obst. et de Gynec. 1: 727, 1921. (14) *Cassidy, M., and Norbury, L.:* Lancet 1: 98, 1911. (15) *Munroe, H.:* J. M. A. Georgia 6: 169, 1917. (16) *Scheid, F.:* Zentralbl. f. Gynäk. 46: 1485, 1922. (17) *Fiolle, J.:* Bull. et mém. soc. nat. de chir. 53: 1238, 1927. (18) *Anspach, B.:* Am. J. Obst. 66: 553, 1912. (19) *Cohen, M.:* J. A. M. A. 80: 382, 1923. (20) *Vigholt, W.:* Acta obst. et gynec. Scandinav. 7: 310, 1928. (21) *Norris, C.:* Am. J. Obst. 63: 850, 1911. (22) *Ruder, E.:* Zentralbl. f. Gynäk. 45: 45, 1921. (23) *Haultain, W.:* J. Obst. & Gynec. Brit. Emp. 8: 27, 1905. (24) *Bauer, A. W.:* Zentralbl. f. Gynäk. 52: 2590, 1928. (25) *Gillies, J. C.:* Brit. M. J. 1: 187, 1926. (26) *Jefferson, J. C.:* Brit. M. J. 1: 55, 1926. (27) *Caraven, J.:* Bull. et mém. Soc. nat. de chir. Par. 53: 550, 1927. (28) *Heil, K.:* Zentralbl. f. Gynäk. 45: 498, 1921. (29) *Thorek, M.:* M. J. and Record 125: 470, 1927. (30) *Payr, E.:* Deutsche Ztschr. f. chir. 85: 392, 1906. (31) *Sellheim, H.:* München. med. Wchnschr. 69: 1297, 1922. (32) *Mochring, E.:* Die Medizin, Welt 3: 369, 1929. (33) *Brown, H. P.:* Surg. Clin. N. A. 9: 1197, 1929. (34) *Küstner, O.:* Zentralbl. f. Gynäk. 15: 209, 1891. (35) *Schwarzwaller, G.:* Zentralbl. f. Gynäk. 48: 2287, 1924.

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EIGHT YEARS' EXPERIENCE WITH ROENTGEN DIAGNOSIS IN GYNECOLOGY*†

PNEUMOPERITONEUM AND LIPIODOL IN PELVIC DIAGNOSIS

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ALTHOUGH roentgenography has been employed in diagnosis in almost every branch of medicine and surgery, the gynecologist is about the last to appeal to its aid. True, the methods applicable to pelvic roentgenography are more complicated than those ordinarily used and require the cooperation of the gynecologist during the procedures. However, they are methods of precision and accuracy, and in questions of doubt or differences of opinion they may be used alone or in combination to visualize the pelvic viscera on the roentgen film and thus frequently establish the diagnosis. The methods are safe if ordinary care and skill are employed and if the indications and contraindications are carefully observed. In my experience over eight years, including over 530 cases of pneumoperitoneum and over 200 cases in which lipiodol was used, no accident or complication was encountered. As a result of my experience it is my belief that visualization of the pelvic viscera by roentgen means is of distinct value

to the gynecologist and should find a place in his diagnostic armamentarium.

The Rubin test has gained a permanent place in the orderly investigation of the childless woman. In addition, its use has been extended to transuterine abdominal inflation for diagnostic pneumoperitoneum. The demonstration of a subdiaphragmatic meniscus of gas by fluoroscopic or roentgenographic means is positive evidence of tubal permeability, and with larger quantities of gas than are needed for the patency test, the abdominal and pelvic organs may be visualized.

When a test for tubal patency is indicated, the method of choice is the Rubin test with carbon dioxide under manometric control. Kymographic tracings and fluoroscopy are interesting observations but are
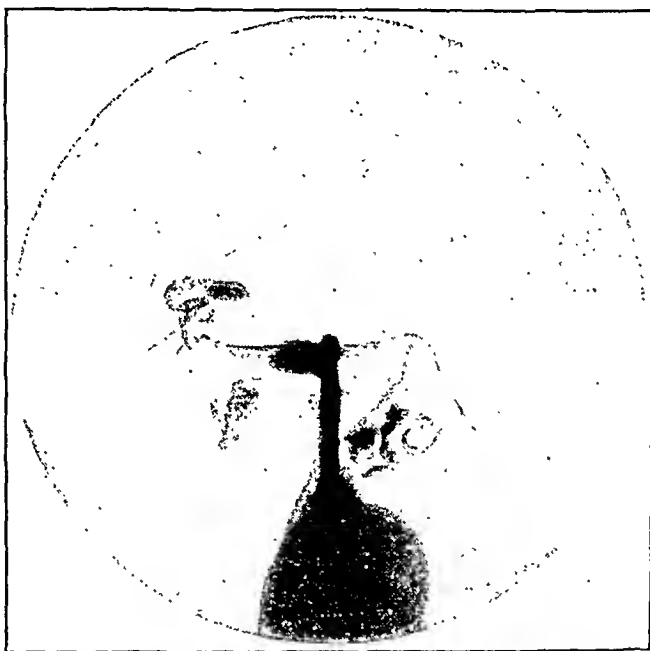
Fig. 1.—Lipiodol instillation. Patent fallopian tubes. "Pearls" of lipiodol in culdesac on right. Tubal sphincters visualized.

not usually essential to the test. If unsatisfactory or inconclusive results are obtained in testing tubal patency, and when diagnostic pelvic roentgenograms are desired, complementary methods employing iodized oil and pneumoperitoneum should be used.

ROENTGENOGRAPHY WITH LIPIODOL USED ALONE

Iodized oil as a radiopaque medium has been used by many gynecologists in place of the usual test with gas or air for the determination of tubal patency in cases of sterility. The chief advantage of using this medium is that the filling may be seen fluoroscopically and the results recorded on the roentgen film. "Spill" is shown unmistakably on the film when some of the iodized oil escapes from the free fimbriated end of one or both tubes. (Fig. 1.) In the event of uni-

lateral "spill," the patent side is unquestionably designated by this means. When "spill" is not shown, however, one may not immediately conclude that there is an obstruction. This conclusion may only be reached after due study of successive films taken over a period of hours or upon repeated tests. If the typical triangular shadow in the uterus is obtained and no oil is found in the tubes, there is an apparent obstruction at the uterine cornua. Note that the term *apparent* is here used, and that the uterine cornua and not the itshmus of the tubes is the location of the closure. The closure is most often due to contraction or spasm of the circular fibers in the uterine horns. This location is not so obvious when lipiodol is used alone, but when combined with the use of pneumoperitoneum, it becomes quite clear. The phenomenon of asynchronous contraction of the cornua frequently accounts for unilateral filling of one tube or the appearance of the tubal sphincter on one side. Rudolph and Ivy[1] have recently demonstrated the same phenomenon in a study of uterine contraction in animals. When the uterine cavity is distended with fluid or gas and pressure is maintained, there is a tendency for the uterus to contract down upon its contents. This contraction naturally closes the uterine cornua. If the pressure is released somewhat, relaxation of the uterine muscle follows, and the fluid will pass through the open fallopian tubes, sometimes both at the same time, sometimes each separately with a variable time limit between the two. I have noted cornual contraction and asynchronous relaxation of the uterine horns in a number of cases when observing them over a period of eighteen to twenty-four hours.

The routine procedure usually followed when lipiodol is used is to instil 5 c.c. of the iodized oil through the self-retaining cannula,[2] the patient lying in the dorsal posture. Three films are then taken about five minutes apart, usually with change of posture from dorsal to partial knee-chest position after the first roentgenogram. If one or both tubes fail to contain lipiodol, an additional 2 c.c. of lipiodol are instilled and another film is taken after twenty minutes. Then the cannula is removed or the pressure is somewhat released, and another film taken after twenty minutes. If filling is still incompete, additional films are taken later on the same and on the following day (the instrument having been removed). When there is no pathologic obstruction present, the eighteen- to twenty-four-hour film will usually record intraperitoneal lipiodol in small scattered irregular quantities in the vicinity of the distal ends of the fallopian tubes or spread about the peritoneal cavity. When there is a pathologic closure, an accumulation of the opaque oil will be recorded which remains constant in location. As was brought out in a previous publication[3] on this subject, when the oily medium enters fluid, as in hydrosalpinx, or encysted or free peritoneal fluid, the oil assumes the form of globules

or "pearls." I have seen the typical "pearl" formation in a number of cases of hydrosalpinx which were later proved at laparotomy.

The use of an iodized oil alone as a means of pelvic diagnosis is definitely limited to scope. To attempt to diagnose tumors, cysts, and tubal pregnancy by this method is apt to lead to error. For intrauterine pregnancy, it is meddlesome, dangerous, and to be avoided, as should all other methods of intrauterine instrumentation. Characteristic alterations in the shape of the filled uterine cavity have led many observers to diagnose fibroids, polyps, bicornuate and double uteri. This may occasionally be satisfactorily done by taking roent-
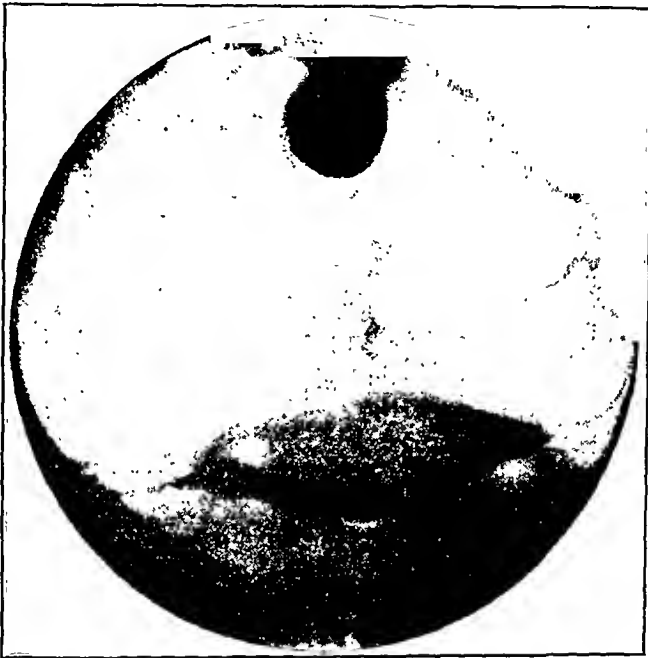
Fig. 2.—Pregnancy at six weeks. Transabdominal pneumoperitoneum.

genograms with the patient in various postures, but the evidence obtained by merely filling the uterus is often incomplete and the resulting diagnosis inaccurate.

PNEUMOPERITONEUM IN PELVIC DIAGNOSIS

When a liter of CO_2 is introduced into the peritoneal cavity either by the transuterine or transabdominal route, and the patient is placed in the partial knee-chest posture, as first described by Peterson,[4] satisfactory roentgenograms of the pelvic viscera can be obtained. The uterus, ovaries, fallopian tubes, and bladder are regularly shown, and the round ligaments are sometimes seen. Thus, the presence or absence of pelvic viscera when in question, hypoplasia, or any alteration in their size, shape, or density is demonstrable. Adhesions of the viscera to each other or to other organs can be shown unless the whole pelvis is obliterated by the inflammatory process. For example, in a case of apparent absence of the vagina in a young woman of twenty-

three years, in whom rectal palpation yielded unsatisfactory findings, a transperitoneal pneumoperitoneum was done and roentgenograms were taken. The films disclosed a normal uterus, ovaries, and tubes. It was thus clear that the vagina was present but undoubtedly oc-
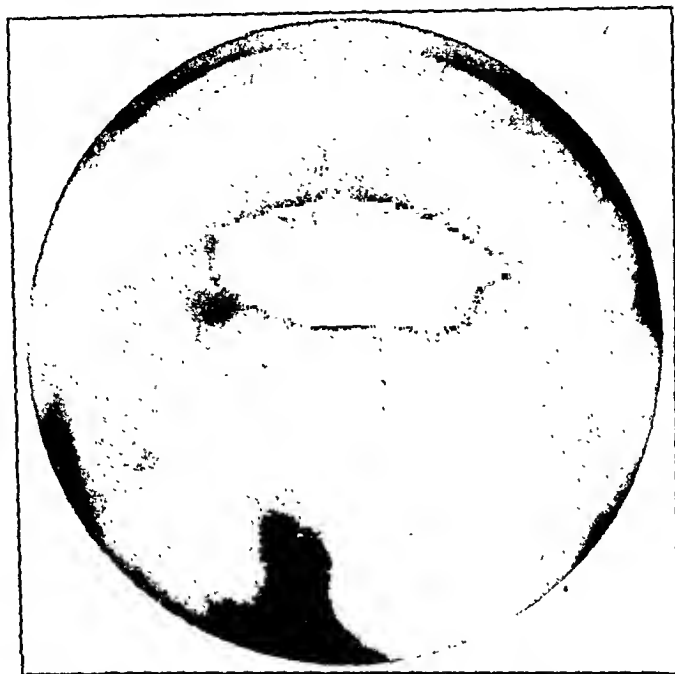
Fig. 3-A.—Pregnancy at six weeks complicated by dermoid cyst. Transabdominal pneumoperitoneum.
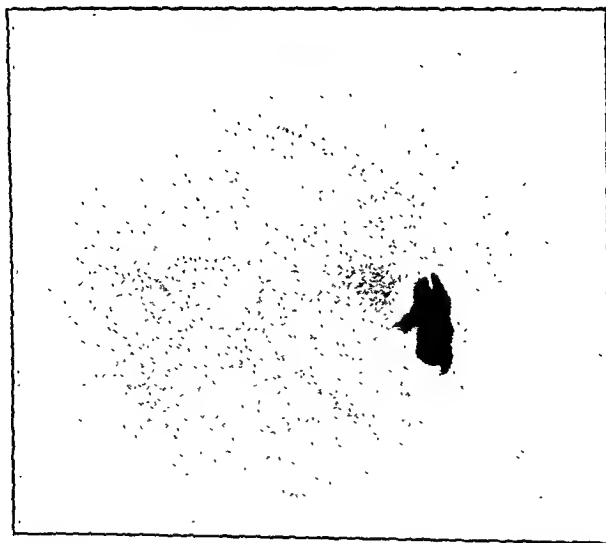
Fig. 3-B.—Dermoid cyst removed during pregnancy.

cluded in early life even though no history of vaginitis was obtainable from the patient or her family. At operation for vaginal reconstruction a pocket of vaginal mucosa was found about the cervix, and following this downward considerable mucosa was uncovered which was utilized in restoring the vaginal canal.

In the diagnosis of early uterine pregnancy, from five to six weeks (Fig. 2), a characteristic picture is obtainable by pneumoperitoneum and no harm results from the transabdominal inflation. By this means intra- and extra-uterine pregnancy, lutein, and other cysts of the ovary may be graphically differentiated. Small ovarian cysts (under 12 cm.) can be clearly shown, and frequently the kind of cyst may be directly recognized. In a young woman suffering from severe vomiting in pregnancy at six weeks, a left-sided cystic swelling was found. Transabdominal pneumoperitoneum revealed a pregnancy of six weeks complicated by a dermoid cyst. (Fig. 3.) The dermoid was removed and pregnancy continued undisturbed. Because of their increased density and smooth capsule, fibroids are usually visualized on the roentgenogram. Their size, if not too large, their number and distribution can be shown. Small fibroids often present greater diagnostic problems than large ones, and these are easily demonstrable by pneumoperitoneum. When fibroids or cysts are associated with
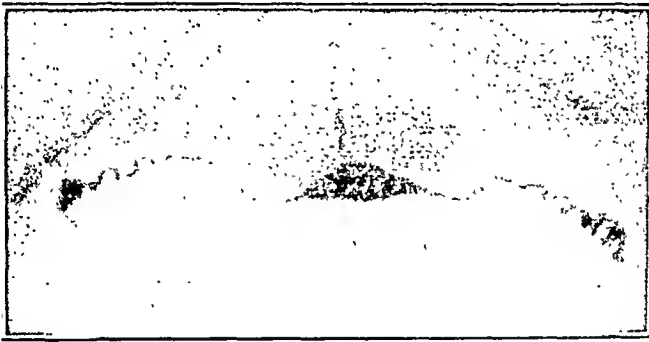
Fig. 4.—Lipiodol and pneumoperitoneum combined. Uterus, tubes, and ovaries clearly visualized. Lipiodol fills uterine cavity and tube lumens.

early pregnancy, the roentgen film after induction of pneumoperitoneum is of great value. The technic and armamentarium[5] for this diagnostic procedure has been previously published.

VISUALIZATION OF THE PELVIC VISCERA WITH LIPIODOL AND PNEUMO-PERITONEUM

In many cases of difficult or doubtful diagnosis, except where lipiodol instillation is contraindicated, such as in bleeding from the uterus, pregnancy, infected uteri, virgins, etc., the two methods mentioned above may be combined. By this means the maximum information concerning the pelvic status may be recorded on the roentgenogram. (Fig. 4.) I have utilized this combination in over 200 cases in the past three years, and I believe that in properly selected cases and with a careful technic it is of greater value than either method used alone. In some instances lipiodol alone will give all the information that is desired; i.e., that the fallopian tubes are patent, and that the uterine cavity is normal in shape and size. In many

cases, by pneumoperitoueum alone, either induced by the transuterine or transabdominal route, a satisfactory film is obtained for intrapelvic diagnosis. By the combined method of pelvic visualization, however,
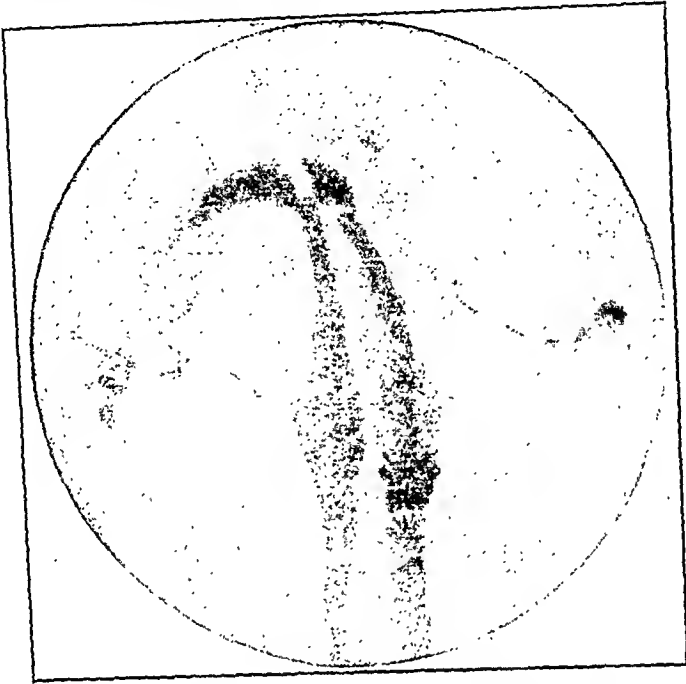
Fig. 5-A.—Lipiodol instillation. Double vagina. Cannula in each cervical os. Suggestive of double uterus.

Fig. 5-B.—Lipiodol and pneumoperitoneum. Single septate uterus outlined by the gas (same patient as in Fig. 5-A.)

one method often complements the incomplete information obtained by the other, and all of the information obtainable is recorded on the

roentgen film. For example, in two cases where lipiodol instillation gave the same picture; i.e., that of cornual obstruction, one was shown by the addition of pneumoperitoneum to be entirely free from pathologic change, the adnexa being clearly outlined on the film, while the other appeared definitely pathologic. The tube and ovary were matted in the latter, the inflammatory damage accounting for the obstruction. Without the addition of the pneumoperitoneum, both cases might have been diagnosed as pathologic closures.

Again, in a patient with double vagina and two ora in the cervix, lipiodol filled two separate uterine cavities as in double uterus. Pneumoperitoneum revealed a single (fused) septate uterus. (Fig. 5.) Similar results obtained with lipiodol alone have been reported as
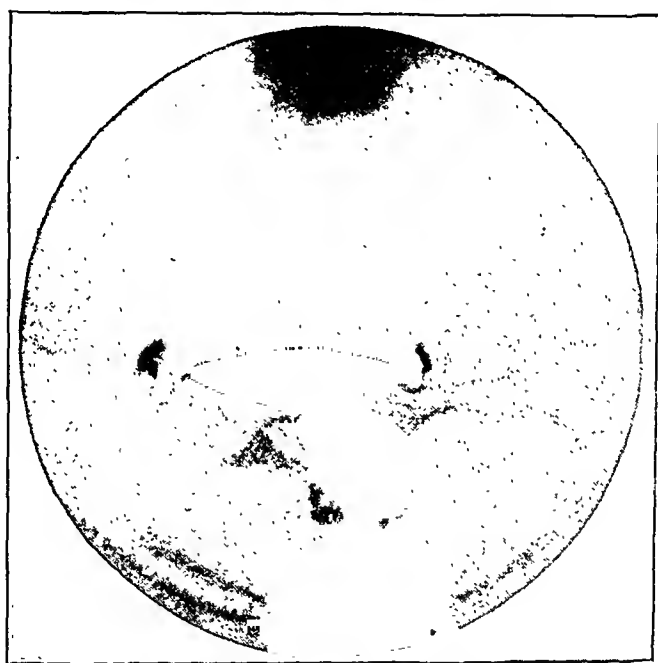
Fig. 6.—Lipiodol and pneumoperitoneum. Arrest of lipiodol in midisthmus of both tubes. Left ovarian cyst. Right adnexa matted.

double uterus[6] in the literature. Another case well illustrates the value of visualization of the pelvic viscera by the combined method. The patient came for a sterility investigation. The only significant datum in the history was a suspension operation for retroversion six years previously at which time the pelvic organs were found normal. Patency test performed with the Rubin apparatus at the office recorded pressures up to 200 mm., with the characteristic kymographic tracing of tubal obstruction. A repeated test at the hospital revealed the same result; therefore 5 c.c. of lipiodol were instilled into the uterus and transabdominal pneumoperitoneum was induced. The films (Fig. 6) reveal a normal uterus, apparent matting of the right tube and ovary, and a left ovarian cyst about 6 cm. in size. The lipiodol fills the uterine cavity and enters both tubes but is arrested symmet-

rically about an inch from each uterine cornu. A series of films taken over a period of eighteen hours disclosed that the points of obstruction were constant. Tubal obstruction in the midisthmus of each tube is visualized here, as well as a left-sided ovarian cyst. Both of the above conditions obviously developed as postoperative sequellae. Whether the fallopian tubes were suspended by mistake, or became adherent at the points of round ligament suspension is a matter of speculation. The result was a bilateral tubal occlusion. The lipiodol indicates the points of obstruction. The pneumoperitoneum defines the location of the closures and visualizes the complicating ovarian cyst.

SUMMARY

1. As proof of a successful Rubin test the subdiaphragmatic meniscus may be demonstrated fluoroscopically and roentgenographically.

2. By the use of lipiodol or other radiopaque liquid, the Rubin test may be complemented or supplemented and the result recorded on a roentgen film. This is of value in recording "spill" in cases of tubal patency, in formation of "pearls" in the presence of fluid, and in defining points of tubal obstruction. Uterine cavity abnormalities may also be recorded. The intrauterine instillation of these substances is contraindicated in pregnancy because of the danger of inducing abortion.

3. By the use of pneumoperitoneum and suitabe roentgen technic the female pelvic viscera may be clearly visualized on the roentgen film. Any condition altering the size, shape, density or relationship of these organs, as well as tumors, pregnancy, and adhesions can be diagnosed.

4. By the use of the two above methods together the maximum information concerning the pelvic organs is obtained. The procedure is a safe and simple one if ordinary care and sufficient time are employed. In my series no accidents or complications have occurred in over 530 cases of pneumoperitoneum and 200 cases in which lipiodol and pneumoperitoneum were combined.

5. In settling differences of opinion and as a matter of permanent record of the pelvic status, roentgenograms with these methods are of great value.

6. Visualization of the pelvic viscera by roentgen methods has a distinct value in teaching gynecology.

REFERENCES

(1) *Rudolph, L., and Ivy:* AM. J. OBST. & GYNEC. 19: 317, 1930. (2) *Stein, I. F., and Arens, R. A.:* AM. J. OBST. & GYNEC. 5: 707, 1928. (3) *Stein, I. F., and Arens, R. A.:* Radiology 15: 85, 1930. (4) *Peterson, R.:* Surg. Gynec. Obst. 33: 154, 1921. (5) *Stein, I. F., and Arens, R. A.:* AM. J. OBST. & GYNEC. 18: 130, 1929. (6) *Witwer, Cushman, and Leucretia:* Am. J. Roentgenol. 23: 125, 1930.

TRAUMATIC SEPARATION OF THE SYMPHYSIS PUBIS

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SEPARATION of the symphysis pubis or rupture of the pubic joint occurs in pregnant women as a result of an external injury or labor. Separation rarely occurs in nonpregnant women, and when it does, it is usually associated with other injuries. It may occur in the pregnant woman before, during, or after labor. The majority of cases associated with pregnancy occur during labor, and are associated with some operative procedure, although spontaneous rupture may occur. Separation occurs infrequently in the pregnant woman according to reported cases.

Braun v Fernwald observed separation of the symphysis pubis in 1 in 10,000 deliveries, Sehauta, 3 in 30,000, Fritz Kayser, 3 in 94,000, Morgan, 2 in 87,000, and Sloane Maternity, 3 in 4,500. In 1898 Paul Rudeaux collected 98 cases, Kehrer collected 100 cases up to 1915. It is estimated as occurring in about 1 out of 25,000 cases. Wishner and Mayer saw 5 postpartum cases in a year and were informed of 6 more. They conclude that it is not as rare as supposed, but often overlooked.

A closer examination of the literature shows that many of the cases reported as rupture of the symphysis pubis are really cases of injury to the back of the pelvis as well as the symphysis pubis. Sacral pains are almost always present. Surely pain in the sacral region has little to do with rupture of the symphysis pubis itself, but depends most likely on an injury to the sacro-iliac articulations. Moeltgen published a case in which there was a separation of the symphysis pubis to the extent of 6 or 7 cm. according to the x-ray. This is unthinkable without injury to the sacro-iliac articulations.

From autopsy findings Westerborn found that if the urogenital trigone holds, it offers sufficient resistance and there is no separation of the pubic bones. From his studies he concludes that a small diastasis of the symphysis pubis can take place without injury to the sacro-iliac articulations. A separation of 40 to 80 mm. produces a bad tear in the sacro-iliac articulations. A separation or dissemination of the lower anterior part of the sacro-iliac articulations up to 10 mm. can take place without rupture of the interossei ligaments. As long as these strong ligaments hold, the joint holds together, and because they do so often hold, the diastasis of the symphysis pubis seldom becomes great. Wishner and Mayer similarly conclude that one or both sacro-iliac joints are involved usually to the extent of tearing of the anterior ligament of one or both sacro-iliacs.

According to Gallet-Duplessis (1893) a separation of the symphysis of 35 to 40 mm. can occur without damage other than a trifling separation of the anterior ligament of the sacro-iliac articulations. Savor-Kayser and Ohlfeld claim that injury to the sacro-iliac articulations occurs with the least separation of the symphysis pubis. Kehrer claims a separation of 3 to 4 cm. can occur without injury. B. Zweifel and Mullerheim state that a separation of 6.5 cm. can occur without injury to the sacro-iliac articulations but a separation of 7 cm. produces a tearing of one sacro-iliac articulation.

The separation may be considerable, but usually it is not great. Westerborn states that it may be from 1 to 7 cm. Maisaunet had a case with a separation of 9 cm. and Lambotte one with a separation of 10 to 12 cm. The separation is said to take place between cartilage and bone as in an epiphyseal separation and not through the cartilage. Breus and Kolisko assert that the cartilage is always torn from one pubic bone; but this, however, is not confirmed. Guibe found at autopsy an example of rupture of the cartilage with pieces adherent to both sides. Murad and Westerborn each published a similar case. One cannot determine this from x-rays, but an operation is necessary to determine the site of separation.

Traumatic separation of the symphysis pubis may be caused by falls, severe strains, and forcible separation of the thighs. Direct, actual force from in front and below the symphysis as well as through forcing the pelvis in front in a sagittal or oblique direction can cause separation. In horseback riding the withers of the horse may serve as the separating wedge. Traumatism through interior or exterior force may cause rupture. Cases have been reported in which, in the opinion of the author (Westerborn), the separation originated through muscle action, i.e. a man who slid with a foot and stood as if about to fall backwards, made a fencing movement, and received the injury. Cases are seen as a result from a fall downstairs or from a wagon. Falling on the buttocks may produce it. DeLee estimates it takes a force of 400 to 2600 pounds to disrupt the pelvic girdle.

Certain causes predispose to separation, as disease of the pelvic joints, disproportion, normal increased mobility during pregnancy, or repeated pregnancies. According to Kehrer there may be a softening or development of cavities in the pubic cartilage and capsule. Caries, rachitis, osteomalacia, chronic arthritis, trauma during pregnancy, and congenital weakness may predispose toward rupture. The majority of cases seen during delivery are due to injudicious methods of delivery. Disproportion helps to expand the pelvis. According to DeLee, the joint is sprung in 75 per cent of operative cases. Sixty-seven per cent of his (DeLee's) cases occurred in forceps deliveries. This may be done by pulling upward too soon in a forceps operation, the head acting as a wedge. It may occur in rare instances in spontaneous deliveries, particularly if the pelvis is contracted in its lower portion. Seventeen of Kehrer's 100 cases occurred in spontaneous deliveries.

In a series of 500 cases, Cautin found an increased mobility in 98 per cent over that of the nonpregnant. Sixteen per cent had only 1 mm. separation. There were symptoms in 15 per cent and in 70 per cent of those giving symptoms there were changes in the gait. Lynch found that widening of the sacrosciatic spaces was almost a constant phenomenon. Only one of his cases showed marked separation of the symphysis pubis, and this returned to normal in fifteen months.

Prognosis.—Rupture of the symphysis pubis, per se, is not serious as a rule. With complications, it carries the risk of these complications, hence there may be a considerable mortality. Healing usually takes place without difficulty. Cohn cites a series of 15 cases in which 6 had rupture of the bladder, one clot and suppuration with prompt recovery on incision; 8 cases recovered, 4 complete, 3 nearly perfect, and one not stated. Union is satisfactory as a rule in traumatic cases and function is good. According to Schauta and Duhrssen, one-third have fever and sepsis. Rudeaux and Struff report 38 per cent as having suppuration. Some die from emboli. There is rarely a return of the rupture and subsequent labors are usually easy. If suppuration occurs, ankylosis may result. Injuries to adjacent viscera, primary hemorrhage, shock, and later sepsis bring the mortality to about 35 per cent.

Treatment.—The patient should be put to bed for from eighteen to ninety days. A pelvic girdle of adhesive or a belt that laces should be applied and kept on for from four to six weeks or the patient suspended in a hammock or sling in the Balkan frame as the weight of the body produces a strong cohesive force. Wishner and Mayer use a somewhat similar type of apparatus as shown below. The knees should be kept together for a week with a pillow placed under them to prevent a sag on the pelvis. A Bradford frame may be used to facilitate nursing care. The patient should be kept recumbent for four to six weeks. Crutches should be used when the patient first starts to walk. If an operation is necessary to get approximation, it usually is simple but it is seldom required. Functional cure is possible with slight persistent separation. Beach reports a case with 3 cm. separation and definite mobility without symptoms.

Effects on Labor.—Some authors consider it advisable to terminate the pregnancy by inducing an abortion or premature delivery, but as a rule this is not justified.

The effect of rupture of the symphysis pubis on labor is the same as symphyseotomy. The capacity of the canal is considerably increased, particularly in the transverse and oblique diameters and to a less extent in the anteroposterior diameter. According to Williams, it is usually stated that the conjugata vera becomes 2 mm. longer for each cm. of separation at the symphysis pubis so that in a gap of 5 to 6.5 cm. the increase would aggregate 12 to 13 mm. A normal labor may be hindered by reason of callus or contraction after healing.

Emgstram had a patient, six months pregnant, who had had tenderness and weakness in the region of the symphysis pubis for five weeks. She fell and had to go to bed because of pain. Later the pain disappeared and somewhat later there was mobility and weakness. Delivery of a large child was spontaneous at term without especially severe pain in the symphysis pubis.

Boorstein reports a case of spontaneous separation of the symphysis pubis at eight months. The patient was a para iv and had had 3 spontaneous labors. She had pain in the symphysis pubis when turning in bed, but no pain while at rest and no dysuria. Adhesive was applied. The delivery was normal and without additional pain. The pain lasted for about two days postpartum.

The 2 cases reported below have been seen on the Obstetrical Service of the Strong Memorial Hospital and present a number of facts of interest.

CASE 1.—Mrs. G. W., a twenty-nine year old para v, was admitted to the Emergency Division on May 6, 1928 complaining of pain and injury in the region of the pelvis. She gave a history of stumbling and falling on her knees on a carpet in her home the day before while carrying her baby in her arms. She experienced a sudden, sharp pain in the front of the pelvis and was unable to get up. She was helped to bed. The pain increased after a few hours and she was scarcely

able to lift her left leg. Later there was backache. The patient was about two weeks from her expected date of confinement. The pregnancy had been normal except for slight edema of the feet and ankles and slight dyspnea. She had voided several times before admission without blood in the urine. Her past history was negative. She had had 4 spontaneous term pregnancies with easy labors and normal puerperia. Physical examination was negative except for the abdomen and pelvis. There was a fair-sized child in R.O.P. with the head engaged. The fetal heart was normal. There was pain over the symphysis pubis when pressure was made. Compression of the crests of the ilium caused pain in the region of the symphysis pubis. Both extremities could be moved voluntarily, the left with more difficulty than the right. There was pain in the lumbar region and around the symphysis pubis on moving the extremities. A catheterized specimen of urine was negative.

Stereoscopic picture of pelvis on admission showed a traumatic symphyseal separation of about 2.5 cm. (Fig. 1). The right pubic bone was considerably higher than the left. The fetal head was deep

Fig. 1.

in the pelvis. The sacro-iliacs could not be seen because of the fetal head. The patient was seen by Dr. Schwartz who advised that she be placed in a hammock with a Balkan frame.

The hammock was suspended from the Balkan frame on each side by a rope as shown through 3 pulleys attached to the frame. Weights were attached to the ends of the ropes of the head and foot of the bed. The ropes were fixed at the points of attachment to the hammock. The hammock just cleared the bed.

After admission the patient had definite pain with soreness over the abdomen suggesting labor pains and the next day was nauseated and vomited. This nausea and vomiting persisted for about ten days to such an extent that the patient was unable to retain anything by mouth so that it was necessary to give saline infusions and intravenous glucose. Her temperature was slightly elevated, 37.8° C. being the highest. The pulse became rapid, 100 to 120, and she had a slight chill. She complained of backache most of the time. Blood chemistry three days after admission showed a CO_2 combining power of 25.5 per cent; uric acid, 6.85;

chlorides, 546; sugar, 83.2; and nonprotein nitrogen 40 mg. per 100 c.c. of blood. The changes in the blood chemistry were due to the starvation and dehydration. Her condition gradually improved and on May 15 the CO_2 combining power was 48.5 per cent. The blood pressure was 130/78 and the pulse slower.

On May 19, thirteen days after admission, the patient was delivered spontaneously of a 4610 gm. female child after an easy five hour labor. The second stage was ten minutes. The biparietal diameter of the child's head was 10 cm. Her symptoms cleared up after delivery. Following delivery, the patient was not suspended in the hammock at night. X-rays the day of delivery showed approximately the same amount of separation of the pubic bones as on admission but the alignment was better. There were suggestive changes along both sacro-iliac joints. The Balkan frame was removed a week later and the patient kept flat in bed. She had slight discomfort in the region of the symphysis pubis for a few days, but otherwise was quite comfortable. She had no difficulty in voiding urine.

The patient was discharged from the hospital one month after admission. Examination at the time of discharge showed the pubic bones to be in good apposition and there was no tenderness on pressure. Vaginal palpation revealed no

Fig. 2.

evidence of callus formation along the pubic rami on either side. Active movement of the legs caused no discomfort and no apparent motility in the joint. Passive motion of each leg separately, particularly if the thigh was slightly adducted, revealed a slight degree of motion in the symphyseal joint. The prognosis in this case seemed excellent. X-rays taken at this time showed the pubic bones to be in good alignment with a separation between the 2 ends of 1 cm. The patient complained of slight discomfort in the right sacro-iliac joint and palpation over both sacro-iliac joints gave one the impression that they were a little wider than normal.

She remained in bed two weeks after going home and returned for observation two weeks later, at which time she felt well. Examination showed a slight notch at the symphysis pubis but no pain or callus. There was slight motility on passive motion of the thighs, not painful. Locomotion was satisfactory. The patient was seen again 2½ months later and felt perfectly well. X-rays at this time showed the distance between the pubic bones to be approximately within normal limits. There were shadows of increased density suggesting callus formation along the superior aspect of the left pubic ramus and also along the inferior aspect of the right pubic

ramus.   The callus which had formed was probably due to periosteal injury rather than actual fracture across the pubic bones (Fig. 2).

The patient was next seen a year later at which time she was 5 or 6 months pregnant.   There were no symptoms referable to the symphysis pubis except a pruritus.   There was a palpable depression along the symphysis pubis.

Fig. 3.

Fig. 4.

X-rays at this time showed the same proliferative change at the superior margin of the left pubic ramus and along the lower margin of the right lower pubic ramus. There was about twice the separation of the symphysis pubis as noted on the last examination, or 11 to 12 mm.

Later in the pregnancy the patient had some difficulty in locomotion and definite palpable separation of the symphysis. These symptoms cleared up. No support or girdle was used.

The patient was delivered spontaneously at term of a 4800 gm. child after a nine-hour labor with a second stage of forty-five minutes. The biparietal diameter of the child's head was 10½ cm.

Two days later x-rays showed a marked farther separation of the symphysis pubis. The width measured 20 mm. The appearance of the pubic bones was unchanged (Fig. 3).

The convalescence was uneventful and afebrile. The separation was still present when the patient was discharged from the hospital, and there was some movement when the thighs were forcibly rocked and abducted.

X-rays at the end of the puerperium showed the separation of the pubic symphysis to be very much less. As measured on the film it was less than 1 cm.,

Fig. 5.

about 8 or 9 mm. There was a ring pessary in place for a retroversion. The separation (Fig. 4), was much less on palpation and no abnormal motion could be elicited. The patient felt well except for some backache at times. Correcting the retroversion relieved the backache.

CASE 2.—Mrs. G. K., a twenty-five year old para iii, was at term when first examined. She had had 2 full-term easy spontaneous labors. Her past history was of interest due to the fact that she had received a fracture of the pelvis eighteen months before in an automobile accident. The fracture had been treated with a body cast and the functional result was excellent. The patient had no symptoms from the fracture until two months before admission. At the time of admission on July 1, 1929, she was scarcely able to stand without holding to something. The pelvic measurements were normal. Stereo and lateral views of the pelvis taken on July 2, 1929 showed a complete fracture of the superior ramus of the left pubic bone several cm. from the symphysis pubis. There was also a line crossing the inferior wings of the ischial bone suggesting an additional frac-

ture.   The most marked mal-alignment had occurred at the symphysis pubis.   A complete separation had occurred at this point and the left pubic bone was approximately 2 cm. higher than the right.   The deformity produced was marked.   The left pubic bone was displaced posteriorly to some extent, though not so much as the upward displacement.   The fracture of the symphysis pubis was such that a large bony fragment measuring approximately 3 cm. in its longest diameter was situated free in the soft tissue.   Situated relatively low in the pelvis was the fully formed head of the fetus (Fig. 5).

On July 8, 1929 the patient was delivered spontaneously of a 4130 gm. male child after an eight and three quarter hours' labor.   Her puerperium was normal. She was discharged from the hospital on the fourteenth day.   There were no symptoms from the fracture of the pelvis at the time of discharge (Fig. 6).

X-rays taken ten days postpartum showed that the relationships were essentially those noted prior to delivery.   There was a large piece of callus superior to the right pubic ramus, which apparently was directed toward the left pubic bone though

Fig. 6.

it had not extended to reach it.   There was a piece of callus near the left inferior ischial ramus which did not appear to come in contact with the bone at any point. The joint space in the sacro-iliac joints was several times the normal width.   No definite slipping was apparent.   The changes in the sacro-iliac joints were probably due at least largely to the recent pregnancy.

The patient when seen a month later was symptomless.

Comment.—The first case is one which was at first thought to be an example of simple rupture of the symphysis pubis, but as was later shown had possible injury to the pubic rami and questionably so to the sacro-iliac joints.   The sacro-iliac joints presented little if any change over the period observed.   The cause of symphyseal separation was probably a combination of indirect violence and muscle action. The child's head may have been jarred into the pelvis with enough force to be an additional factor.   The fact that the patient was a young

multipara was probably a predisposing cause, as it has been shown that the maximum amount of softening and relaxation of the pelvis joints occurs in such cases.

The separation, as measured from the x-ray, was about 2.5 cm. This is within the limits given by several authors in which no more injury than separation of the symphysis pubis results if more than a slight degree of separation takes place. The backache in the region of the sacro-iliac joints indicates that there must have been injury to these joints, even though not definitely shown by the x-rays.

The gastrointestinal symptoms which were present for a time are not so easily explained. No abdominal injury was noted. The pain complained of was not associated with uterine contractions. Injury to the sympathetic system may produce such symptoms as observed in this patient, so that such a cause may be offered as an explanation of the gastrointestinal symptoms.

The injury to the pelvis certainly had no ill effects on the labor which was easy and not more painful than would be expected without such injury. The second labor was somewhat more difficult, but the child was also larger. This case, then, can be classed as one of rupture of the symphysis pubis and possible injury to the sacro-iliac joints as well as the pubic rami in a twenty-nine year old multipara who had 2 uneventful labors and excellent recovery with conservative treatment.

The second case is an example of a case showing that separation of the symphysis pubis and fracture of the pelvis does not necessarily interfere with a normal spontaneous labor. Also, that such an injury may have little effect on subsequent labors.

Both patients had children of excessive size—those of the first patient weighing 4610 and 4800; and the child of the second patient 4130 gm.

The Balkan frame and hammock used on the first case was a very satisfactory mode of treatment. It was comfortable for the patient and her weight when suspended in the hammock gave sufficient cohesive force. She was free with certain limitations to move in bed and the nursing care was made easier.

CONCLUSIONS

1. Separation of the symphysis pubis without further injury to the pelvis is very rare.

2. If there is more than a small amount of separation there is further injury to the pelvis, usually in the sacro-iliac articulations.

3. Rupture of the symphysis pubis, per se, is not serious as a rule and healing is usually satisfactory.

4. Rupture of the symphysis pubis, as a rule, does not necessarily produce a deleterious effect on labor and operative measures are not usually indicated.

5. Subsequent pregnancies may cause a recurrent partial separation but, again, not necessarily affecting labor and the end-result will usually be satisfactory.

REFERENCES

(1) *Beach, R. M.:* Am. J. Obst. & Dis. Women & Child. 75: 203, 1917.   (2) *Boorstein, S. W.:* Am. J. Obst. & Gynec. 13: 345, 1927.   (3) *Cotton, F. J.:* Dislocations and Joint-Fractures, ed. 2, Philadelphia, W. B. Saunders Company, p. 457.   (4) *DeLee, J. B.:* The Principles and Practice of Obstetrics, ed. 5, Philadelphia, W. B. Saunders Company, pp. 413 and 814.   (5) *Keen, W. W.:* Surgery, Its Principles and Practice 2: Philadelphia, W. B. Saunders Company, p. 218. (6) *Kehrer, E.:* Monatschr. f. Geburtsh. u. Gynäk. 41-42: 321, 1915.   (7) *Lynch, F. W.:* Surg. Gynec. Obst. 30: 575, 1920.   (8) *Morgan, William A.:* Am. J. Obst. & Dis. Women & Child. 73: 606, 1916.   (9) *Speed, Kellogg:* A Textbook of Fractures and Dislocations, ed. 2, Philadelphia, Lea and Febiger, p. 570.   (10) *Westerborn, Anders:* Acta Chir. Scandinav. Supp. 7-9 63: Supp. 8, 1, 1926-1928. (11) *Williams, J. W.:* Textbook of Obstetrics, ed. 6, New York, D. Appleton & Co., pp. 1, 612, and 921.   (12) *Wishner, J. G., and Mayer, L. W.:* Surg. Gynec. Obst. 49: 380, 1929.

PRIMARY CARCINOMA OF THE FALLOPIAN TUBE

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TUMOR growths originating in the fallopian tubes are not very frequently encountered and because of the great similarity in signs and symptoms of such tumors to other more common pelvic conditions, the diagnosis is seldom made clinically prior to operation and pathologic examination of the specimen. The literature of the subject has been fully reviewed by Wechsler[1] and more recently by Callahan[2] and Watkins.[3] It is the purpose of this paper to add another case to the literature and also discuss some of the salient features which such cases present.

CASE REPORT

A. D., aged fifty-five years, American, housewife, was admitted on August 15, 1930, to the Missouri Baptist Hospital complaining of vaginal discharge, nervousness, and palpitation of the heart. The patient had had no previous severe illnesses or operations. She had had three full-term pregnancies, and there had been no miscarriages or abortions. The menstrual cycle was normal in every respect until the onset of the menopause five years ago. Since then she developed symptoms characteristic of the climacteric.

The onset of the present illness dates back to two years ago when she gradually developed a watery vaginal discharge. The discharge, intermittent and scanty at the start, had become more profuse and continuous during the past five months; it turned sanguinous during the last three weeks. The discharge was odorless but rather annoying on account of its frequency and the need of constant changing of vaginal pads. The appetite had been good although she believes that she lost a small amount of weight. There had been no abdominal pains or soreness; she was somewhat constipated and resorts daily to mild cathartics to secure constant bowel action.

Physical examination on admission to the hospital revealed a well-developed and fairly well-nourished white female displaying a moderate degree of pallor of the mucous membranes. Heart and lungs were normal; blood pressure was 220/110.

Vaginal examination disclosed a cystocele and a small erosion of the cervix. The uterus was small and retroplaced; the adnexa were not palpable.

Laboratory Findings.—Red blood cells 3,500,000, white blood cells 8,500, and hemoglobin 65 per cent. Blood nonprotein nitrogen 30.0 mg. per 100 c.c., blood sugar 0.085 per cent. The urine showed a few hyaline and granular casts.

A clinical diagnosis of a probable malignancy of the uterus was made. Operation was performed on August 16, 1930, under spinal anesthesia. The abdomen was opened through a midline incision extending from the symphysis pubis to the umbilicus. The uterus, both ovaries, and the right fallopian tube were found to be normal in appearance. The left fallopian tube was enlarged in its distal third and had the form of a club-shaped tumor, the latter measuring about 5 cm. in diameter. The tumor was slightly adherent and easily separated from the posterior parietal peritoneum. The fimbriated end of the tube was occluded and the serous surface of the enlarged portion was injected and discolored. The gross appearance of this tube at the time of the operation was indistinguishable from a

Fig. 1.—Low power photomicrograph showing the microscopic appearance of the tumor. Note the papillary projections of the tumor and the associated inflammatory changes in the tubal wall.

chronic inflammatory process, but due to the fact that the lesion was confined to only a portion of one tube, it aroused the suspicion that it might be malignant. A panhysterectomy was therefore performed and the abdomen closed in the usual manner.

Pathologic Findings.—The uterus, both ovaries, and the right fallopian tube were normal in appearance. The distal portion of the left tube was enlarged and measured 5 cm. in diameter; the fimbriated end was completely closed. The serous surface of the tube presented a purplish discoloration with a few roughened areas due to adhesions. Cut section through the enlarged portion of the tube revealed numerous pedunculated and sessile papillary growths arising from the tubal wall. The lumen was filled with necrotic débris that had a brownish discoloration. Grossly, this tumor growth appeared as malignant.

Microscopic Observations.—Sections taken from the uterus, both ovaries, and the right fallopian tube revealed no histologic abnormalities. Sections taken from the left tube containing the tumor mass disclosed a very thickened wall apparently due to overgrowth of fibrous tissue. The latter was infiltrated with numerous inflammatory cells. The normal mucosal folds were entirely absent and their place was occupied by papillary outgrowths that projected into the lumen of the tube.

The central friable portion of the tumor was composed of papillary chains of cells which in places were so crowded together as to lose their original papillary pattern. The cells were mostly of low columnar type. A striking feature of these papillary projections was the absence of the centrally formed fibrous tissue core which is so commonly seen in such tumors. (See Fig. 1 and 2). In addition to the main papillary tumor, there were also found areas composed mainly of solid nests of cells which carried an insignificant amount of connective tissue stroma. These areas lacked any particular architectural structure and were composed essentially of large polygonal and oval or spindle-shaped cells, that had a clear faintly staining cytoplasm and hyperchromatic nuclei. Mitotic figures were very numerous. All the coats of the tube were invaded by tumor tissue, the latter reaching as far as the serosal surface. A great number of the lymph spaces were found plugged with nests of tumor tissue but the blood vessels escaped any such invasion.

DISCUSSION

The clinical features presented by this case are very similar in
very little additional comment. The disease occurs as a rule in indi-
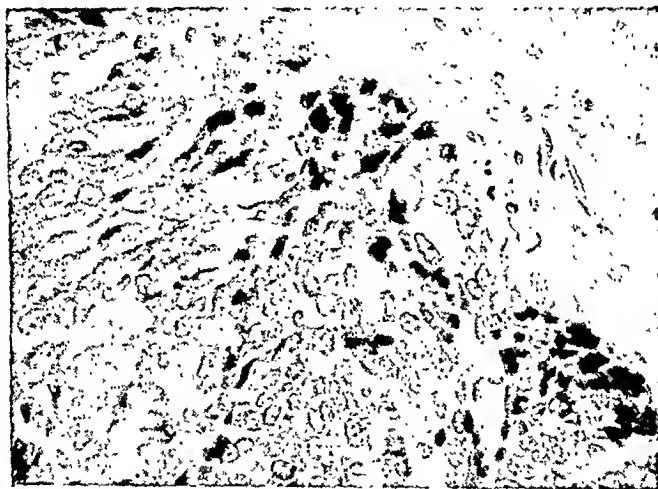
Fig. 2.—High power photomicrograph of same tumor shown in Fig. 1. Note the size and shape of the cells and the numerous mitotic figures in the section.

viduals at or past the menopause which is the age incidence of all other types of malignant tumors. It manifests itself in a variety of form and presents such a confusing and indefinite symptom complex as to render a clinical diagnosis very difficult. Because of the close similarity of the disease, both in signs and symptoms to other more common pelvic conditions, it is very frequently diagnosed either as a tubo-ovarian or uterine neoplasm or as a pelvic inflammatory condition. The frequent occurrence of second inflammatory changes in the tumor complicates still further the clinical picture and masks the true condition of the disease. The commonest symptoms, however, which these patients present are watery or serosanguinous vaginal discharge with or without abdominal pains. Both the abdominal pain and the vaginal discharge may vary in character and severity in different individuals

or in the same individual at different epochs of the disease. The discharge may thus be scanty or profuse, continuous or intermittent, watery, serosanguinous, hemorrhagic, or purulent, while the pain may be dull, achy, or cramp-like in character. Depending upon the size and position of the tumor in the pelvic cavity, there may occur either urinary or intestinal disturbances such as frequency and urgency of urination or constipation and obstipation. In spite of the usual malignant anatomic characteristics of this tumor, marked loss of weight and cachexia are very seldom observed, although undernourishment and anemia are more commonly seen.

The physical findings are not at all pathognomonic of the disease and very often are indistinguishable from other pelvic conditions. Occasionally a tumor mass may be felt on either side of the uterus or in the pouch of Douglas. The size of the tumor varies from the thickness of the little finger to that of a large mass which may fill the abdomen and reach as far as the xyphoid process. The tumor is either freely movable or fixed in position, all depending upon its invasive properties or upon secondary inflammatory changes in the tumor, that may cause immobilization through the formation of adhesions.

The commonest site of origin of the tumor is from the middle or distal third of the tube. When formed, it may be unilateral or bilateral. The abdominal ostium is very frequently closed, most probably by the tumor itself.

Microscopically, two common varieties of the tumor are recognized, namely, (1) papillary and (2) papillary-alveolar. Various modifications of these two patterns are sometimes seen in different tumors. The normal mucosal folds are usually replaced by arborescent branching, the latter consisting of a central fibrous tissue core upon which is mounted one or several layers of cuboidal epithelium. The cells vary in size and shape and may assume either a round, polyhedral or oval form; the cytoplasm is usually clear and the nucleus hyperchromatic. Mitotic figures may be very numerous or very scanty; occasionally they are entirely absent. The central portion of the tumor mass very frequently undergoes necrosis and becomes infiltrated with the various inflammatory cell elements. Such necrotic pieces of tumor may be thrown off into the lumen of the tube and completely occlude it. Metastasis occurs very often in the retroperitoneal lymph nodes and in adjacent structures especially the ovaries and uterus.

The etiology of this disease has been disputed and subjected to a great deal of discussion. Many observers attributed the cause of this tumor growth to irritation resulting particularly from long-standing inflammation, but since the true etiology of the disease is not determined, one is reduced to speculations regarding the mode of dependence of the tumor process upon the irritant. Sanger and Barth[4] believed that salpingitis was the essential forerunner and causative agent in the genesis of the disease, while Doran[6] and others believed that

these growths were secondary to malignant changes taking place in a benign papilloma. The upholders of the former theory base their arguments mainly on the finding of inflammatory changes in these affected tubes. Such evidence, however, must be taken with a great deal of caution in interpreting its bearing on the origin of carcinoma. It is true that chronic salpingitis is very often found in association with this disease but this does not prove that the neoplasm is a result of the inflammatory process. On the other hand, it is not uncommon to find secondary inflammatory changes in any kind of carcinoma, particularly in the rapidly growing types of tumors, and one is not justified in concluding, therefore, that the inflammation was the cause of the tumor formation. This is particularly well illustrated in our case, where evidence of inflammation was noted only in the cancer-bearing tube and was entirely absent in the other uninvolved tube. Since inflammation of the fallopian tubes is very rarely a unilateral process, we hardly believe that the inflammatory changes found in the carcinomatous tube of our patient were primary, but in all probability these were secondary to the carcinomatous change. Inflammation of the fallopian tubes is comparatively a common occurrence, yet the development of carcinoma in such organs is unusually rare. This may be taken therefore as an argument to contradict the assumption that the tumor process is dependent upon previous inflammatory changes. It is quite possible, however, that the changes produced by the inflammatory process as a result of constant irritation, prepare the soil for the development of secondary neoplastic changes in an organ susceptible to the disease.

Another important phase of the question worth mentioning is the gross anatomic similarity of the tumor to that of inflammation, and unless the organ is very carefully examined both grossly and microscopically, such tumors may pass our attention and remain undiagnosed. A superficial inspection of the tumor recovered from our patient was hardly distinguishable from that of a thickened chronically inflamed tube. Microscopic examination of the tube, however, revealed the true nature of the disease.

SUMMARY

A case of primary carcinoma of the fallopian tube is presented. Some of the important phases of the disease are briefly discussed.

REFERENCES

(1) *Wechsler, H. F.:* Arch. Path. 2: 161, 1926. (2) *Callahan, W. P., Schiltz, F. H., and Hellwig, C. A.:* Surg. Gynec. Obst. 48: 14, 1929. (3) *Watkins, R. E., and Wilson, W. M.:* Surg. Gynec. Obst. 51: No. 1, 1930. (4) *Sanger and Barth:* In A. Martin, Handbuch der Weiblichen Adnexorgane 1: 251, 1895. (5) *Doran, A. H. G.:* J. Obst. & Gynec., Brit. Emp. 17: 1-23, 1910.

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INTRACRANIAL HEMORRHAGE OF THE NEWBORN

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NO GREATER menace jeopardizes the life or the future well-being of the newborn child than intracranial hemorrhage, with its trail of suffering, idiocy, epilepsy, paralysis, and death. When we consider the forces and structures incident to our initiation into "light," the marvel is that they occur so infrequently. Various reports have made it as high as 50 per cent of the causes of death in the first few days. It may occur after a normal spontaneous delivery, breech or vertex, in long hard labors or in short precipitous deliveries, but is of greatest incidence in complicated cases requiring major obstetric procedures.

Cruveilhier[1] in his "Atlas" of 1832 illustrated intracranial hemorrhage of the newborn. Cushing,[2] in 1905, reported on cases treated surgically. But the real beginning of modern studies and opinions began in 1910 when Beneke[3] emphasized his method of postmortem examination by which the falx and tentorium are intact for inspection.

Various theories have been advanced for the explanation of the occurrence of the hemorrhage. Hemorrhagic diathesis, once considered a primary factor is now being put a little to one side as having been overemphasized. Holland[4] in his wonderful paper attributes it to the changes in the shape of the head in process of molding. The compression with the raising of the vault and septa causes tearing or obstruction with overdistention of veins. Seitz and Schwartz[5] have set forth the belief that the difference of intrauterine and extrauterine pressures causes the frequent cephalhematomas and also intracranial hemorrhage. Ehrenfest[6] explains it on a theory of parietal bones overriding. In a recent publication (*Cumulative Supplement and Composite Index to Gynecological and Obstetrical Monographs, 1928**) he reviews and discusses the various theories. He quotes Greenwood as showing by plaster casts of the skull of the immediate newborn, that there is an overlapping of the parietal bones in a normal vertex anterior delivery. And that lengthening is in the anterior posterior diameter and· not in the vertical. In the after-coming· head deliveries, the vertical diameter is always increased. Ernest Sachs[7] in Abt's Pediatrics says, "the principal cause of this grave accident is the springing apart of the bones when the head is suddenly released from the compression of the birth canal, combined with the fact that the veins passing from the cortex of the sinus are for a short distance unsupported and therefore much more readily injured."

A visit to the postmortem table and the examination of the infant's skull, opened by the method of Beneke, will serve to impress on us the factors of the stress and strain placed on the falx and tentorium by the molding of the head during its passage through the birth canal. Molding of the head by pressure on the occiput, frontal, and parietal areas causes elongation toward the vertex and base, thus causing the falx to pull on the tentorium, often beyond its stretching point. This

causes a tear, involving smaller or larger vessels as the case may be. This method of examination has probably overstressed the findings of a torn falx or tentorium, and a study of the damage to the brain tissues has thus been neglected. More recently a modified Beneke method is being used, in which the brain tissue is hardened, fixed, and sectioned. Schwartz (*Ztschr. f.d. ges. Neurol. u. Psychiat.* **90**: 263, 1924) is quoted as reporting hemorrhage or distinct areas of degeneration of the brain substance in 65 per cent of all infants up to five months.

SOURCE OF MATERIAL

The material for this study is based on the records of the Philadelphia Lying-In Hospital from October 1, 1927, to December 1, 1929. During this period there were 2256 deliveries. Of this group 78 babies were stillborn, giving a percentage of 3.46 per cent. The living births were 2178, with 81 deaths, or 3.71 per cent death rate.

Autopsy was secured on 53 of the 78 stillborn, with permission to open the head in 31 cases. In this group there were 11 cases of intracranial hemorrhage or an incidence of 35.4 per cent. Of the 81 deaths, 66 came to autopsy and the head was opened in 56 cases with intracranial hemorrhage present in 18 or 32.1 per cent.

After carefully checking all cases and discarding those of doubtful diagnosis, we found that there were 16 additional babies, with intracranial hemorrhage, who were discharged from the hospital either cured or greatly benefited by treatment. Then, of the 2256 deliveries we feel quite certain of making a diagnosis of intracranial hemorrhage in 45 or 1.9 per cent. Undoubtedly there were additional cases of hemorrhage, symptomless or having such indefinite or mild symptoms that they escaped our notice.

TABLE I.   OCCURRENCE OF HEMORRHAGE IN 2256 DELIVERIES

	NO. OF CASES	% OF TOTAL	POST-MORTEMS	POST-MORTEM ON HEAD	WITH HEMORR.	% WITH HEMORR.
(a) Stillborn	78	3.46	53	31	11	35.4
(b) Deaths	81	3.71	66	56	18	32.1
(c) Hemorrhage with recovery	16	0.007			16	
(d) Total with hemorrhage	45	1.91				
(e) & (d) : 35.5% of cases with hemorrhage recovered.						

PREDISPOSING CAUSES

Incidental Factors.—According to Table II, a study of the incidental factors occurring in the 45 cases of intracranial hemorrhage, we find that the incidence of hemorrhage is slightly greater among the white than among the colored race. This is even more striking than the

figures indicate, since the majority of cases delivered were colored. It may possibly be accounted for by the fact that the average birth weight of our colored babies is about one pound less than that of the white babies, thereby causing less difficulty during delivery.

In this group there is very little difference in the occurrence of hemorrhage, whether the child be of a primiparous or a multiparous mother. The same applies as to whether the child was male or female.

The average age of the mother is twenty-four years, the youngest being sixteen years; the oldest thirty-seven years. In all of the 45 cases there was nothing particularly wrong in the prenatal health of the mother. There is no way of ascribing the cause to a deficient diet.

Quite a remarkable fact brought out is that 35 of these babies were full term, while only 10 were premature infants. In 4 cases there was a positive Wassermann.

TABLE II.   FORTY-FIVE CASES OF INTRACRANIAL HEMORRHAGE

	STILLBORN	DEATHS	RECOVERIES	TOTALS
Colored	7	9	3	19
White	4	9	13	26
Primipara	7	7	9	23
Multipara	4	11	7	22
Male	5	8	9	22
Female	6	10	7	23
Age of mother	23	25	24	24
Prenatal health good	11	18	16	45
Gestation {Full term	8	11	16	35
{Premature	3	7	0	10
Positive Wassermann	2	2	0	4

HOURS OF LABOR AND TYPE OF DELIVERIES

Referring to Table III we note that in 22 of the cases, the mother was in labor less than twelve hours, and in 21 the length was over twelve hours. In 2 cases the time was unknown. It is difficult at times to be certain of the length of the second stage of labor, but it is this stage which has a decided influence in the causation of intracranial hemorrhage. A precipitous delivery with a short hard labor is a dangerous thing for the infant. The injudicious use of pituitrin can be condemned, especially from the viewpoint of the infant.

It was noticed also, during the review of the records, that a large majority of the 45 cases developed after the mothers had been in the second stage of labor for two hours or more. It is our feeling that the obstetrician should use careful judgment in allowing any mother in the second stage of labor to continue over the two-hour period. Although 10 of the cases were delivered by forceps, which in this series had 2.3 per cent incidence of hemorrhage, and 14 by versions, which has an incidence of 7.6 per cent with hemorrhage, we feel that with few exceptions, a greater danger exists in permitting long labors than

in the skillful performing of some operative obstetric procedure. The 13.8 per cent occurrence of hemorrhage in the cases delivered by normal or spontaneous breech is very outstanding. The spontaneous vertex delivery, uncomplicated or with only minor complications has the lowest incidence, being 0.8 per cent in this series.

It is interesting to note that there was one case of intracranial hemorrhage in a baby delivered by cesarean section. This particular case occurred in a baby whose mother was in labor for thirty-eight hours without progress. There was no dilatation or effacement of the cervix. Contracted pelvis was also present. Cesarean section was performed. On delivery the child had to be resuscitated by carbon dioxide and oxygen. Progress was satisfactory for twenty-four hours, although the child did not nurse well. It then began to vomit blood and had respiratory difficulty. Forty c.c. of the mother's blood were given during the second day. The child died at the end of forty-eight hours from apparent respiratory failure. Postmortem examination showed hemorrhagic areas in the lungs, stomach, and intestines, also into the scalp with a marked subdural hemorrhage over the entire surface of the brain and into the lateral ventricles. No tears were found in the falx or tentorium. The bone marrow of the femur was blood red and of dry fatty consistency. Accordingly, we feel justified in making a diagnosis of hemorrhagic disease of the newborn with intracranial hemorrhage. In all probability the latter occurred during the long labor and was the cause of difficult resuscitation and early poor nursing.

TABLE III-A. LABORS AND DELIVERIES

	STILLBORN	DEATHS	RECOVERIES	TOTALS
Under 12 hours	7	10	5	22
12 to 24 hours	2	3	3	8
24 hours and more	2	5	6	13
Unknown				
Spontaneous	2	7	2	11
Forceps	3	2	5	10
Version	4	4	6	14
Breech	2	4	3	9
Cesarean	0	1	0	1

TABLE III-B. HEMORRHAGE ACCORDING TO DELIVERIES

	NO. OF CASES	NO. WITH HEMORR.	% WITH HEMORR.
Spontaneous	1482	11	0.8
Forceps	438	10	2.3
Version	183	14	7.6
Breech	65	9	13.8
Cesarean	88	1	1.1

In 18 of the cases, 14 of which died and 4 recovered (see Table IV), there was some difficulty with the primary respirations, making it necessary to use some form of resuscitation. Our delivery rooms are

equipped with a carbon dioxide-oxygen apparatus as recommended by Henderson,[8] and a modified Drinker respirator. As far as possible, all forms of artificial respiration of any other type have been abandoned. The matter of holding the baby vertically by the feet and slapping the trunk, or compressing the chest by manipulation of the infant's body, are questionable procedures, and may increase cerebral congestion or hemorrhage. Efforts at mouth to mouth insufflation, in certain cases may be sufficient to rupture air vesesls; or in other cases the air may be forced into the stomach. It would seem that the carefully regulated pressure of the carbon dioxide-oxygen apparatus is the method of choice, or the modified Drinker respirator.

SYMPTOMS

The symptoms as found in the 34 cases born alive, show that 94 per cent of the group were fretful; that is, they had a sharp, piercing, or at times a plaintive cry and did not sleep well. The fretfulness was increased by handling and particularly when the head was moved or when food was offered or other general care given. Six per cent were apathetic and made no sound of any kind. Seventy-six per cent nursed poorly, or not at all, and had difficulty in swallowing. The poor nursing consisted in lack of the sucking reflex when the nipple was placed in the baby's mouth. The difficult swallowing consisted in choking, regurgitation, and in some cases projectile vomiting when forced feeding was tried.

Intermittent cyanosis was present in 64 per cent. It has been observed that continuous cyanosis is more often associated with atelectasis and congenital heart disease or the less common cases of phrenic nerve paralysis. It is very unlikely that an intermittent cyanosis at this age would come from an enlarged thymus. The cyanotic spells may come on suddenly, provoked by disturbing the child for feeding. The best relief is secured by the administration of carbon dioxide and oxygen. During the acute stage, gentle artificial respiration may be carried on and respiratory stimulants, such as atropine or alphalobelin, given hypodermically. Prompt treatment is esesntial, as it is in one of these attacks that sudden death may occur. For this reason constant supervision must be maintained.

Muscular twitchings or convulsions were present in 58 per cent. The muscular twitchings are usually limited to the eyes and face, but may involve any or all extremities. Stern and Schwartz place great emphasis on the nystagmus of the first few hours of life and its relation to the amount of intracranial damage. Occasionally the muscular twitching develops into clonic convulsions with retraction of the head, arching of the back, and general spasticity. In such cases the prognosis is very poor. It does not seem possible to localize the hemorrhage by observation of these muscular twitchings. Also it would

seem that while the reflexes are generally increased, they, too, fail to give any localization.

From general observation of the cases which recovered we note an excessive loss of weight and that fever occurred in 85 per cent of these cases prior to the time of their lowest weight. This point we consider very significant in differentiating intracranial hemorrhage from dehydration fever. In the latter, the fever occurs at the point of lowest weight.

TABLE IV. WEIGHT—TEMPERATURE—SYMPTOMS

	STILLBORN	DEATHS	RECOVERIES	TOTAL
Birth weight				11
Under 6 pounds	4	7		
Over 6 pounds	7	11	16	34
Loss of weight				
Less than 8 ounces			5	5
8 to 16 ounces			9	9
16 ounces and more			2	2
Temperature				
Subnormal		2		2
Normal		8	4	12
Above normal		8	12	20
Symptoms				
Fretfulness		16	16	32 –94%
Poor nursing		13	13	26 –76%
Poor swallowing		14	12	26 –76%
Cyanosis (intermittent)		17	5	22 –64%
Muscular twitching		14	6	20 –58%
Primary respirations good		4	12	16
Primary respirations difficult		14	4	18
Apathetic		2	0	2

In arriving at a diagnosis of intracranial hemorrhage it must not be forgotten that a definite history of the hours of labor, type of delivery, and the primary respirations are important in conjunction with the symptoms presented.

From the diagnostic standpoint, lumbar or cisternal puncture findings furnish the most conclusive evidence of intracranial hemorrhage. Nevertheless, we feel that errors in diagnosis may be made by depending entirely on these findings. Errors in technic may easily occur whereby bloody fluid is secured. Pressure varies with the position of the child, its crying and struggling, and may lead to false conclusions. Our technic is as follows: A 20-gauge standard spinal puncture needle carrying a stylet is used. This is cut so as to be two and one-half inches long and have a sharp point with a short bevel.

For cisternal puncture the child is held horizontally on its right side, with its head supported and held in partial flexion by the left hand, and the legs and trunk controlled by the right hand of the assistant. The skin over the upper cervical and occipital area is prepared by painting with tincture of iodine, 3 per cent, and washing with alcohol. The needle is inserted into the pit formed by the edge of the foramen magnum and the spinous process of the atlas in the midline in a plane extending through this point, the external auditory canals, and the

glabella. The point of the needle thus often striking the edge of the occipital bone, when the butt of the needle is manipulated, is made to enter the foramen magnum. At the instant the resistance ceases, the point of the needle is in the cisterna magna. The needle has thus been inserted about three-fourths to one and one-half inches, depending upon the size of the child and the amount of subcutaneous tissue. The stylet is then removed and a pressure reading taken with a mercury manometer. When the pressure is high and the fluid is bloody, removal of from 5 to 10 c.c. of spinal fluid is permitted, or of whatever quantity is necessary to reduce the pressure to normal. Following the puncture, a gauze or cotton dressing is applied to the area, and the child is placed in the horizontal position in a warm bed.

Since cisternal puncture should be done only by an expert because of the possible dangers, for oft-repeated drainages or for diagnostic purposes on the child not acutely ill, we use lumbar puncture.

Following the suggestion of Glaser,[9] lumbar puncture is done with the child in vertical position. The assistant holds the child between the palms of the extended hands, the fifth fingers hooked under the knees, the thumbs over the shoulders and the other fingers supporting the sides of the child and holding it firmly to prevent lateral motion. The head of the child is supported by its lying forward against the wrists, thus giving firm support and stability to every part and not placing any strain on the child's body.

SPINAL FLUID FINDINGS

According to Table V, authentic spinal fluid pressures were recorded in 6 of the infants that died, 16 who recovered, and in 66 normal symptomless infants. The pressure findings showed an average of 15.7 mm. in the group which died, 11.5 mm. in the recovered, and 8 mm. in the normal cases. The fluid was yellow in 32 of the normal cases, all of which showed red blood corpuscles microscopically. Clear fluid was found in one infant that recovered. This same fluid had a negative benzidin test and there was no microscopic evidence of blood. It was under a normal pressure of 6 mm. However, muscular twitchings of the face and eyes were present, and the child nursed poorly, and now at five months of age shows retardation in its mental and physical development. However, some malformation of the brain may have existed to account for this. Clear fluid was also found in 20 of the normal cases, all but two showing red blood corpuscles microscopically.

TABLE V. SPINAL FLUID FINDINGS

	DEATHS	RECOVERIES	NORMAL
Number of cases	6	16	66
Average pressure	15.7	11.5	8
Type of fluid			
Bloody	6	15	14
Yellow	0	0	32
Clear	0	1	20

Probably the most important point to be learned from this spinal fluid study is the increase of pressure found in the cases of hemorrhage. It is more or less true that the greater the pressure, the larger and more serious the hemorrhage; also that hemorrhage cases almost invariably have bloody spinal fluid. But it is to be remembered that bloody fluid is found in normal symptomess infants which can probably be ascribed to unavoidable rupture of vessels while doing the puncture. Note, too, that a rare case of hemorrhage may have a clear spinal fluid.

The spinal fluid findings do not give any indication as to the location of the hemorrhage, which is an important factor in prognosis. Referring to Table VI, it is noted that of the 28 intracranial hemorrhage cases coming to autopsy 15, or 53.5 per cent, had hemorrhage at the basal area and an additional 4 cases had basal and cortical hemorrhage, making a total of 67.8 per cent with hemorrhage around the midbrain and its important vital centers. If one considers only the infants born alive, and dying with intracranial hemorrhage, such a hemorrhage was found at the base of the brain in 15 of the 17 cases or in 82.2 per cent. Some of these babies lived only a short time, 1 living five minutes, another twenty minutes, or according to Table VII, 10 babies lived less than twenty-four hours, 4 babies lived from twenty-four to forty-eight hours, 1 five days, 1 seven days, 1 nine days, and 1 fifteen days.

TABLE VI.   HEMORRHAGE IN 28 CASES

	STILLBORN	DEATHS	TOTALS
Location			
Cortical	6	1	7
Basal	4	11	15
Combined	1	4	5
Intracerebral	1	1	2
Amount			
Large	7	11	18
Small	4	6	10

TABLE VII.   DURATION OF LIFE IN 18 CASES

Less than 24 hours	10 cases
24 to 48 hours	4 cases
5 days	1 case
7 days	1 case
9 days	1 case
15 days	1 case

TREATMENT

As in all other afflictions of humanity, preventive treatment is the ideal, the golden fleece for which the medical profession of today is seeking. Such treatment must of necessity begin with the mother who should provide a healthy body to be the fountain of her offspring. In pregnancy she should have monthly examinations and proper super-

vision. A suitable diet with the necessary vitamins, as pointed out by Moore and Brodie,[10] is an important factor; also rest, exercise, and the other things contributing to the ideal prenatal health.

Better natal care with wise judgment in the use of pituitrin, forceps, version, section, and all the procedures of obstetric surgery is necessary; also proper intervention or nonintervention in labor; and better methods of handling and resuscitation of the newborn, using preferably the carbon dioxide and oxygen apparatus, or the Drinker respirator.

The transfusion of whole blood, we believe, is one of the greatest measures that has been advocated. Give 20 c.c. (ten in each buttock or interscapular area) of the mother's blood to the child before leaving the delivery room in cases of difficult labors and major obstetric procedures.

Careful nursing supervision and feeding are very important. Attempt to keep these infants as quiet as possible with the least amount of handling when changing is necessary. Feed by gavage when the difficulty of nursing and swallowing is noticeable. Give breast milk if it is at all available; otherwise, give skim lactic acid milk.

Bathing and dressing of the child will depend entirely upon the conditions. One or both may be omitted to provide for rest and quietness of the child.

Supportive treatment can always be given. Give minims III of spiritus frumenti in water with the feedings every three hours; atropine, $\frac{1}{1000}$ gr., hypodermically, and Alpha-lobelin may be used as necessary. Provide for maintenance of body heat by a hot bed.

Do repeated drainage of the spinal fluid. This procedure may be contested by many authorities, but we believe that many lives may be prolonged and many infants live to become useful citizens because of this procedure.

SUMMARY

A study of 45 cases of cerebral hemorrhage is here presented. General incidence of hemorrhage among 2256 deliveries is 1.9 per cent. Of the stillborn babies that came to postmortem 32.1 per cent had hemorrhage. After discarding questionable cases, we find that 16, or 35.5 per cent, of the babies with hemorrhage have recovered.

The classical symptoms of hemorrhage were: A history of difficult delivery, difficult resuscitation, fretfulness, inability to nurse and swallow properly, intermittent cyanosis, muscular twitchings, excessive loss of weight, fever within the first two days, and increased intracranial pressure with bloody fluid.

Intracranial hemorrhage was found in infants delivered spontaneously, by forceps, versions, and breech extractions; in rapid precipitous deliveries and in prolonged and difficult labors.

We were unable in these cases to determine the size and location of the hemorrhage by clinical methods. Autopsy showed that a large proportion of the hemorrhages occurred in the basal areas.

In the fatal cases the infants nearly all died within forty-eight hours.

Drainage was done on 66 normal babies showing an average spinal fluid pressure of 8 mm. of mercury, bloody fluid in 14 cases, yellowish fluid in 32 cases, and clear fluid in 20 cases.

The treatment consisted of careful nursing and feeding, gavage when necessary, quiet and rest, stimulation, and repeated drainage for the relief of pressure symptoms.

CONCLUSIONS

1. Long second stage of labor, precipitous delivery, and difficult obstetric procedures are the chief causes of intracranial hemorrhage.

2. Prenatal health of the mother and hemorrhagic disease of the newborn do not seem to be important causative factors.

3. History of delivery, clinical symptoms, and lumbar or cisternal puncture are the essential points of diagnosis.

4. Repeated drainage of spinal fluid with relief of increased pressure is a most valuable means of treatment. Equally essential is good nursing and feeding care.

5. Preventive measures consist in skillful obstetric procedures, the use of carbon dioxide and oxygen for resuscitation, or the Drinker Respirator, and the transfusion of whole blood intramuscularly in all cases of possible hemorrhage.

REFERENCES

(1) *Cruveilhier:* Paris, 1829-1835. (2) *Cushing:* Am. J. M. Sc. 130: 508, 1905. (3) *Benekè:* München. med. Wchnschr. 7: 2125, 1930. (4) *Holland:* Trans. Edinburg Obst. Soc. 40: 122, 1919, 1920. (5) *Seitz and Schwartz* (Quoted from A. Capper, Am. J. Dis. Child. 35: February and March, 1928.) (6) *Ehrenfest:* Am. J. Dis. Child. 26: 503, December, 1923. (7) *Sachs:* Abt's Pediatrics. Vol. VII, p. 88, 1926. (8) *Henderson:* J. A. M. A. 90: 583, Feb. 25, 1928. (9) *Glaser:* Am. J. Dis. Child. 36: 195, August, 1928. (10) *Moore and Brodie:* Am. J. Dis. Child. 34: 53, 1927.

334 SOUTH TWENTY-FIRST STREET.

MORTALITY IN HYSTERECTOMY OPERATIONS*

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HYSTERECTOMY is one of the most generally performed of all operations. Its technic is well established. It is carried out daily by the gynecologist, the general surgeon, the occasional operator, and even the general practitioner. In properly selected cases it is one of God's greatest blessings; in improperly selected cases it may prove a curse by blasting the lives of the happily married, destroying all hope of progeny and producing a long period of morbidity which occasionally ends in insanity or suicide. If any reform is to be made regarding this popular operation it must originate with the gynecologist. The gynecologist should teach the profession and the laity the evil results of unsexing women in active sexual life, he should show by example the advantages of myomectomy over hysterectomy in certain cases.

Radium and x-ray should be substituted for hysterectomy in cases of hyperplasia, the so-called functional bleeding of the menopause and in many cases of fibroid tumors. The gynecologist should not only preach conservatism in inflammatory cases but should practice it.

The object of this paper is to show that hysterectomy has a mortality. One may occasionally run a series of 100 cases (usually selected) without a death but such statistics are of little value and sometimes harmful. It is only by reporting and making a careful study of the causes of death that a reduction in mortality and morbidity may be expected.

In reviewing a series of 200 consecutive hysterectomies at the Vanderbilt University Hospital, nine deaths were found to have occurred. All cases were included in which the cause of death was either immediate or remote. This gives a general mortality for the operations of 4.5 per cent. Table I shows the type of hysterectomy performed with the mortality for each group:

TABLE I

	NO.	MORTALITY PER CENT
Supravaginal hysterectomy	166	4.2
Complete abdominal hysterectomy	32	3.1
Chemical hysterectomies	2	50.0

TABLE II.   CAUSE OF DEATH IN NINE CASES

	NO.	PER CENT
Pulmonary embolus	3	1.5
Peritonitis	3	1.5
Shock and hemorrhage	2	1.0
Zinc chloride poisoning	1	0.5
Total	9	4.5

It is our purpose in this paper to discuss some of these causes of death in an attempt to reduce their incidence.

PULMONARY EMBOLISM

For this most unfortunate complication we are at a loss to offer any suggestions other than those commonly employed such as frequent changes of posture.

The state of the circulation is always a prime consideration with the surgeon. A few years ago all circulatory deaths were labeled as "heart failure." The war studies in regard to wound shock and the more recent studies at Vanderbilt University[1] have emphasized the great importance of peripheral circulatory failure as a cause of operative mortality.

The heart itself is rarely responsible for operative deaths provided the individual had a normal heart before operation. Even in patients with fairly advanced heart disease operative mortality is not extremely high. However, one must remember that postoperative pneumonia and embolism are much more common in patients with cardiac disease, and it is these complications rather than heart failure per se which should be of greatest concern. Proper preoperative treatment by rest, fluid restriction, digitalis, and diuresis when necessary, enable one to operate with a fair degree of safety on most patients with disease of the heart.

Another point to bear in mind in the question of cardiac failure as a complication of surgery is the question of age. The older the patient with cardiac disease the more likely is postoperative pneumonia to occur. A young individual with severe cardiac valvular disease is likely to withstand operation better than an elderly person with coronary arteriosclerosis. Patients with angina pectoris are, as a rule, very poor operative risks.

PERITONITIS AND BLOOD STREAM INFECTION

This complication occurred three times, two of the cases are directly attributable to intestinal injuries which resulted from freeing adhesions. In the third case the infection resulted from cutting across the cervix in a case where a presumably large myoma of the corpus was present. To our chagrin the bleeding came from a carcinoma which had not

been diagnosed and which extended into the cervix below the line of incision. The consequent soiling of the pelvis resulted in peritonitis.

Two of these cases came to autopsy and in both, cultures from the hearts blood were positive. In one case where a rent occurred in the sigmoid, drains were placed through stab wounds just above the crest of the ilia. The rent was carefully closed with two layers of interrupted intestinal catgut sutures. The sigmoid was dropped into the bottom of the pelvis and the omentum was spread over the pelvis. At autopsy the sutures in the intestine had sloughed out and the lumen was open for a short distance. In spite of this the infection was entirely localized to the pelvis and death was the result of blood stream infection. It would have been better if linen had been used instead of catgut. It is noteworthy in this series of cases that peritonitis only occurred when an infected viscus was opened.

Many of our cases were admitted to the hospital in a markedly anemic and septic condition, as a result of infected and degenerated myomas. We have come to rely on the sedimentation time as the best index of operability. The sedimentation time in these cases was forty-five minutes, thirty-three minutes, and sixteen minutes respectively. It should be borne in mind that the sedimentation time is a better index of tissue degeneration than of actual infection, but since tissue degeneration and infection usually go hand in hand it serves as a useful guide to infection. It is our present policy never to operate in the presence of a low sedimentation time but rather wait for it to rise.

SHOCK AND HEMORRHAGE

The similarity between the symptoms of shock and hemorrhage are too well known to require comment here. It has been clearly shown that in so-called traumatic shock the symptoms are really due to a loss of blood in the traumatized tissue itself. In hemorrhage the output of the heart is markedly diminished before the blood pressure begins to fall. The diminished volume of blood is compensated for by a decrease in the size of vascular bed as a result of vasoconstriction and in this condition a patient may have a very greatly impaired circulation with very slight changes in blood pressure. Our experience has led us to believe that in most cases of so-called surgical shock, hemorrhage is either the chief or a contributory factor. There are undoubtedly cases of shock in which hemorrhage is not a factor. This type of shock has been produced experimentally as a result of bullet wounds in the axilla.[2] In this type of shock, vasodilatation is the rule in contradistinction to vasoconstriction in the hemorrhagic type. We feel, however, that the bloodless type of shock which has been designated as neurogenic is comparatively rare and it is our firm belief that the avoidance of blood loss would eliminate shock as a factor in pelvic surgery. One of our patients was operated upon under spinal anes-

thesia. In this case we were faced with the unusual condition of a double uterus with fibroids in each horn. A mild hemorrhage occurred from the endometrium. The patient went into profound shock shortly after being returned to the ward, and died. We were unable to explain this death and did not know whether to attribute it to the spinal anesthetic or not. The clinical fact that a patient under spinal anesthesia suffered a mild hemorrhage with fatal results could not be overlooked.

Animal investigations were undertaken on spinal anesthesia and it was shown that the fall in blood pressure is the direct result of vasodilatation.[3] The cardiac output decreases[4] after the pressure falls and for this reason the low pressure of spinal anesthesia is better tolerated than a low pressure from hemorrhage. A patient with a blood pressure of 80 mm. under spinal anesthesia may have a larger cardiac output than one suffering from hemorrhage who has a normal pressure. In spinal anesthesia a good portion of the vasomotor system of the entire body is paralyzed and when we consider that the compensatory mechanism of the body in hemorrhage is vasoconstriction, it is apparent that when spinal anesthesia is administered this compensatory mechanism for hemorrhage is also paralyzed.

Experiments show that normal dogs can stand[5] a blood loss of from 3 to 5 per cent of their body weight, but when spinal anesthesia is administered losses of only 1 per cent are serious and may be fatal. Consequently, we feel that the explanation for the case given above is at hand. The use of ephedrine clinically or experimentally has never completely obviated this danger, although it is the most powerful stimulant that we have. The value of transfusion in cases of lowered blood pressure from hemorrhage, neurogenic shock or spinal anesthesia cannot be overestimated. In these conditions it is almost specific.

ZINC CHLORIDE POISONING

In view of the recent appearance of several articles on chemical hysterectomy and the use of zinc chloride, by Masson,[6] Mayo,[7] Babcock[8] and others, one of our cases is of unusual interest. The patient aged thirty-five, bleeding as a result of hyperplasia of the endometrium was curetted under spinal anesthesia, the uterus was packed with gauze saturated with 50 per cent zinc chloride. Immediately the patient showed evidence of respiratory distress and shortly died. Upon testing the toxicity of zinc chloride it was found that a dosage of 7.8 mg. per kilo was lethal for dogs. It was obvious in this case that zinc chloride is extremely toxic and is entirely too dangerous to be used in the uterus. Babcock cited numerous cases in the German literature of the use of zinc chloride resulting fatally. We mention this method only to condemn it.

CONCLUSIONS

1. A series of 200 hysterectomies of various types performed for a variety of pathologic conditions is reported with the mortality of 4.5 per cent. The value of the sedimentation time is stressed.

2. The value of transfusion as a preventive for shock rather than as a therapeutic measure for shock is advocated.

3. The danger from hemorrhage under spinal anesthesia has been shown.

4. Zinc chloride as an agent for chemical hysterectomy is condemned.

REFERENCES

(1) *Blalock, A.:* Arch. Surg. 15: 762-798, 1927. (2) *Blalock, A.:* Arch. Surg. 20: 959-996, 1930. (3) *Burch, J. C., Harrison, T. R., and Blalock, A.:* Arch. Surg. 21: 693-697, 1930. (4) *Burch, J. C., and Harrison, T. R.:* Arch. Surg. 21: 330-332, 1930. (5) *Ibid.* (6) *Masson, J. C.:* AM. J. OBST. & GYNEC. 10: 355-364, 1925. (7) *Mayo, C. H.:* Tr. South. Surg. Assn., 1929, p. 79. (8) *Babcock, W. W.:* AM. J. OBST. & GYNEC. 7: 693-696, 1924.

OBSTETRIC MORTALITY

AN ANALYSIS OF 2268 MATERNITY CASES AT THE BRONX HOSPITAL*

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IN VIEW of the latest report on obstetric mortality in New York City, which emphasizes the high rate as compared with other cities of this and European countries, a determined effort has been made on the part of the several medical societies of New York City to ascertain the facts and conditions leading to this high death rate. The purpose is to correct the causes at their origin, or at least, to bring before the attention of the medical profession those elements which contribute directly or indirectly to the ill effects on mother and child.

This paper, in an attempt to bring out the details leading up to such maternal and fetal deaths, is presented in the hope that by means of such figures and data as have been gathered over a period of three and one-half years from 2268 consecutive cases on the Obstetric Service of the Bronx Hospital, some further light may be shed upon the relation between the obstetrician's handling of the case in accordance with the best teaching of today and the ultimate result.

As a preliminary it is necessary to define certain terms and conditions referred to in this paper:

1. The Obstetric Service of the Bronx Hospital admits patients pregnant five months or more. The "lying-in" period averages ten days postpartum.

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2. The Prenatal Department admits patients at any time after a positive diagnosis of pregnancy has been made.

3. The Ward Service and Prenatal Clinic are directly under the supervision of the Obstetric Staff, but the ''courtesy'' or private service is not subject to the same strict surveillance, although it is necessary for the latter to observe the same rules for asepsis and medical care as the former.

4. A stillbirth is a fetus in whom there has been no respiratory effort on the part of the child, whether or not there has been any heartbeat before or after delivery.

5. A neonatal death is one that occurs any time after the first respiratory gasp and within the ten-day ''lying-in'' period in the hospital.

6. A premature baby is one that was less than nine lunar months in utero, or, where the time factor was not available, that weighs less than 1600 grams (3½ pounds). This figure is chosen arbitrarily as the one closest to the period of viability.

During the years of 1927, 1928, 1929, and the first six months of 1930, there were delivered at the Bronx Hospital, 2268 mothers and 2290 babies. During this period there were 6 maternal deaths, 52 stillbirths, and 30 neonatal deaths.

Considering the maternal cases first, there were 6 deaths out of 2268 total consecutive confinements, a mortality rate of 0.27 per cent; i.e., 2.7 per thousand, or 1 in 377 cases. The histories of two of these patients who died are briefly as follows:

1. A case of uterus didelphys in which there appeared symptoms of acute inflammation of abdominal viscera. The patient was operated upon and found to have a necrotic right ovary and diffuse Streptococcus hemolyticus peritonitis from which she died three days later. Within twenty-four hours postoperative a premature stillbirth was delivered spontaneously.

2. A case of acute intestinal obstruction with possible neoplasm, complicating a pregnancy in a cardiopath. Surgical consultation advised against laparotomy. Labor was induced by means of a Voorhees bag, and the baby delivered with medium forceps; but the patient died suddenly four hours later of cardiac decompensation.

In an attempt to arrive at a figure directly attributable to institutional care and Obstetric Staff responsibility, it has been deemed advisable to subtract these two cases from the total of six maternal deaths, thus leaving a corrected percentage of 0.18 per cent; i.e., 1.8 per thousand, or 1 in 566 cases. In this connection the figures for the New York City Health Department for the entire city show for the

TABLE I.   MATERNAL DEATHS

	YEAR	NUMBER OF CASES	NUMBER OF DEATHS	PER CENT RATE	PER THOU-SAND
New York City	1929	124,404	629	0.50	5.0
Nursery and Child's Hospital	1929	2,180	6	0.27	2.7
Woman's Hospital	1928-9	2,713	26	0.95	9.5
Lying-In Hospital	1929	4,653	21	0.45	4.5
Bronx Hospital	1927-8-9	2,268	6	0.27	2.7

corresponding period of time a maternal death rate of 0.52 per cent in 379,625 births.

Table I shows a comparison of figures of maternal deaths in several hospitals of New York City.

In the four remaining maternal deaths there were:

> One cesarean section
> One internal podalic version and extraction
> One forceps delivery
> One spontaneous delivery

A consideration of the operative cases follows:

There were performed 23 cesarean sections in 2,268 cases delivered, an incidence of 1.0 per cent, or 1 in 98 cases, with a maternal mortality rate of 4.3 per cent for this operation. Death in this case was due to eclampsia with hypertension, cerebral hemorrhage, and coma. The operation per se was not in any way responsible for the fatal outcome, since the patient at the time of the cesarean section was unconscious and moribund.

Internal podalic version and extraction were resorted to in 25 of the 2,268 deliveries; i.e., 1.1 per cent, or 1 in 90 cases, with a maternal mortality rate of 4.0 per cent for this maneuver. Death here occurred in a patient admitted to the hospital as an emergency case because of prolonged labor and exhaustion. To correct a persistent occipito-posterior position, the Kielland forceps were applied but without success. This was followed by an internal podalic version and the baby extracted. The mother, however, died within twenty-four hours with symptoms of acute cardiac failure.

Forceps deliveries were accomplished 137 times in 2,268 confinements, an incidence of 6.04 per cent, or 1 in 16 cases, with a maternal mortality of 0.67 per cent for this operative procedure. This included high forceps, midforceps A and B, Kielland and Scanzoni maneuvers, and low forceps. Death occurred in a case of persistent occipito-posterior position in which Kielland medium forceps were employed to hasten the second stage of labor. Following delivery, symptoms of concealed hemorrhage appeared, and the patient died on the third day postpartum.

In the remaining patient who was delivered spontaneously of triplets, death was due to postpartum sepsis following the retention of secundines with subsequent infection.

In considering the death of the babies, there are the following items of interest. There were born 2,290 babies to these 2,268 mothers, including 20 sets of twins and 1 set of triplets. Of these there occurred:

> Stillbirths   52, or 2.2%, or 22 per thousand
> Neonatal deaths   30, or 1.3%, or 13 per thousand

a total death rate of 82 in 2,290 births; i.e., 3.5 per cent, or 1 in 28. The Department of Health (1929) figures show a fetal death rate of 7.6 per cent. This, however, includes embryos in all periods of gestation. Table II shows a comparison of fetal death rate of various hospitals in New York City:

TABLE II. FETAL AND NEONATAL DEATHS

	YEAR	NUMBER OF CASES	NUMBER OF DEATHS	PER CENT RATE	PER THOU- SAND
New York City	1929	124,404	9,496	7.6	76
Nursery and Child's Hospital	1929	2,174	110	5.0	50
Woman's Hospital	1928-9	2,748	175	6.3	63
Lying-In Hospital	1927	5,508	379	6.8	68
Bronx Hospital	1927-8-9	2,290	82	3.5	35

Bearing in mind the definition previously given of a stillbirth, as a baby in whom no respiratory effort has been made at any time, these cases are further classified as follows in Table III.

TABLE III. STILLBIRTHS

	NUMBER OF CASES	PER CENT OF TOTAL BIRTHS
Premature (1600 gm. or less)	10	0.39
Full-term, operative	22	0.96
Full-term, spontaneous	20	0.87
Total	52	2.27

In the consideration of neonatal deaths all cases are included in which the baby breathed even once and in which death occurred either immediately thereafter or within the first ten days of the puerperium at the hospital. These are classified in Table IV as follows:

TABLE IV. NEONATAL DEATHS

	NUMBER OF CASES	PER CENT OF TOTAL BIRTHS
Premature (1600 gm. or less)	15	0.69
Full-term, operative	5	0.21
Full-term, spontaneous	10	0.42
Total	30	1.32

Also it is of interest to consider the type of delivery in conjunction with the death of the full-term baby. This is detailed in Table V:

TABLE V. FULL-TERM FETAL MORTALITY

	STILLBIRTHS	NEONATAL
Operative delivery	22	5
Spontaneous delivery	20	10
Total	42 +	15 = 57

We see here that of the full-term babies, the number of stillbirth and neonatal deaths total 57 out of 2,290 births. Also, that the fetal deaths occurring in spontaneous deliveries outnumbered those in operative deliveries, 30 to 27.

Next in order is a consideration of the important causes of death in these 82 babies, of which 57 were of full-term gestation and 25 were premature. This is shown in detail in Table VI.

TABLE VI. CAUSE OF DEATH

| | FULL-TERM | | PREMATURE | TOTAL |
	STILLBIRTH	NEONATAL		
Asphyxia and atelectasis	36	4	23	63
Cerebral hemorrhage	1	8		9
Anomalies and malformations	4	3	2	9
Fractured vertebra	1		.	1
Total	42	15	25	82

It is seen thus that asphyxia and atelectasis accounted for the greatest number of deaths, 63, most of which occurred in utero. The diagnoses of these deaths were based on clinical, x-ray, and autopsy findings. The 9 cases of congenital anomalies, all of which occurred in the fetal deaths noted above, are detailed in Table VII.

TABLE VII. CONGENITAL MALFORMATIONS AND ANOMALIES

	STILLBIRTH	NEONATAL
Diaphragmatic hernia	.	2
Patent foramen ovale	.	2
Hydrocephalus	1	
Polycystic kidney	1	
Cleft palate and harelip	1	
Anencephalus		1
Spina bifida	1	

Possibly of greatest importance in the study of cause and effect are Tables VIII and IX in which are set down the more common causes and conditions occurring in obstetric practice, and the methods employed to deliver the baby in these cases.

TABLE VIII. ABNORMAL CONDITIONS DURING LABOR

| | FULL-TERM | | PREMATURE | TOTAL |
	STILLBIRTHS	NEONATAL		
Maternal toxemia	9		2	11
Prolapsed cord	8			8
Placenta previa	1	1	2	4
Persistent posterior position	6			6
Maternal cardiac decompensation			2	2

Of these the greatest incidence of fetal mortality occurred with maternal toxemia as a cause eleven times, while prolapsed cord accounted for eight deaths. The operative procedures employed in the delivery of the baby are detailed in Table IX.

TABLE IX. OPERATIVE PROCEDURES

| | MOTHER | | | BABY | | | | |
| | TOTAL | MATERNAL DEATHS | PER CENT RATE | FULL-TERM | | PREMATURE | | PER CENT RATE |
				STILL-BIRTH	NEO-NATAL	STILL-BIRTH	NEO-NATAL	
Forceps	*137*							
High	2			1				50
Mid	29		.		4		1	16
Low	83			1				1.1
Scanzoni	3			1				33
Kielland	20	1	5.0	1				5
Cesarean section	23	1	4.3	2	1	1		17
Internal podalic version and extraction	25	1	4.0	10	3	1	1	60
Breech presentation and extraction	38			4		1	1	15
Total	223	3	1.3	24	4	3	3	14

It must be noted here that 2 cases have been omitted from this table, the two maternal deaths not considered as purely obstetric fatalities. These have been discussed in the early part of this paper.

It is interesting to observe that of the 2,268 deliveries, 233 were operative procedures; yet there were only 3 maternal deaths (corrected), or 1.3 per cent, and 34 fetal and neonatal deaths, or 14.5 per cent. Among the spontaneous deliveries, which numbered 2,035 cases, there was but 1 maternal death, or 0.04 per cent; while there were 48 fetal and neonatal deaths, or 2.3 per cent.

At the Bronx Hospital, the Kielland forceps were usually applied in cases of persistent occipitoposterior position in preference to the Scanzoni or Pomeroy maneuvers. In 22 attempts at Kielland maneuver, internal podalic version was subsequently employed twice. Among the remaining 20 successful attempts, there was one maternal death (the concealed hemorrhage), and one fetal death.

In reviewing the foregoing facts and figures, one is struck by the various causes of maternal and fetal death, and the numerous operative procedures. The question naturally arises, have the greatest care and maximum precautions been taken to insure the best results for the patient? Is it possible to reduce the death rate still further? According to Polak, "maternal mortality is made up of infections, toxemias, hemorrhages, obstetric accidents, and operative deaths, all to some extent preventable."

It is conceded that prenatal care is of utmost value in the reduction of obstetric morbidity. However, it is inevitable that even in clinics in which prenatal care is strongly emphasized, a certain number of patients will be lost. There will always be some deaths due to embolism and cardiac failure. Cerebral hemorrhages and paralyses occasionally occur, as well as acute abdominal infections, with a high mortality rate. Eclampsia may occur even in the most carefully watched case in which all precautions have been taken, though the

incidence has been markedly diminished in the last few years. The "human factor" is always present, more so in the class of people that goes to make up ward cases, and the strictest warnings and sincerest advice often fall upon deaf ears and ignorant minds, rendering valueless all the scientific precautions and skillful obstetric procedures.

This, in a measure, is also true of fetal mortality which depends upon several factors.

1. Placental disease caused by intercurrent infections, toxemias, and lues. These explain the majority of prematures, macerated babies and congenital anomalies and malformations.

2. Malposition and disproportion causing dystocia and increasing fetal distress.

3. Character of labor and type of operative delivery causing cerebral hemorrhage, asphyxia, fractures, palsies, etc.

Owing to strict supervision of obstetric cases, during the antepartum period as well as during the hospital stay, the number of fetal deaths would seem to have been materially reduced here as compared with published figures of other institutions and of New York City generally. However, this paper is not intended as a comparative study of the several hospitals mentioned in the tables, since the conditions governing the admission of patients vary, as well as the social status of the patients themselves.

SUMMARY

The figures quoted above and the tables outlined, indicate a maternal mortality per 1000 of 2.7, a stillbirth rate of 22, and a neonatal death rate of 13. The number of maternal and fetal deaths has reached a low figure at the Bronx Hospital. This has been brought about, first, by concentration of care upon the mother in the last three months of pregnancy; second, by a general attitude of conservatism during labor, with interference only when delay and procrastination might possibly result in morbidity or death.

THE ORAL ADMINISTRATION OF SODIUM ISO-AMYLETHYL BARBITURATE (SODIUM AMYTAL) IN LABOR

A PRELIMINARY REPORT*

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AMYTAL (iso-amylethyl barbituric acid) was synthesized in 1923[1] and was described as the most active hypnotic of the dialkyl derivatives of barbituric acid.

Details for the preparation of sodium amytal (sodium iso-amylethyl barbiturate) were described in 1926.[2] During the past seven years amytal or sodium amytal has been used by a number of experimenters with animals.[3, 4, 5, 6, 7, 8, 9, 10, 11, 12] Zerfas and his coworkers[13] first described, in 1929, the use of sodium amytal intravenously to produce anesthesia in the human being. Since that time, it has been administered clinically by the following routes: intravenously,[15, 16, 18, 19, 20, 21] intramuscularly,[22] rectally,[14] and orally.[15, 16, 17, 23] Its advantages in surgery as an anesthetic and for preanesthetic preparation have been described.[13, 15, 16, 17, 18, 24, 25, 26] Its ability rapidly to control the convulsions of eclampsia,[18, 22, 27] of tetanus,[18, 20] and of cocaine and of novocaine poisoning,[20] has been established. A number of writers[14, 18, 20, 22, 28] has described its use in obstetrics; the method of administration in these cases has almost uniformly been intravenously.

As there has been no description of the oral administration of this drug in labor, this work was undertaken to evaluate its effectiveness and to determine the proper system of dosage.

Dosage.—This has proved quite difficult. The lethal dose for man is not known, and no direct application can be made of fatal doses established for certain animals.[29, 30, 32] The upper margin of a safe dose intravenously has been placed at twenty-five grains[31] and we have not exceeded this, but our total dosage during labor has in several instances reached thirty grains.

Administration.—We have administered sodium amytal orally so far to fifty patients. No attempt was made to select the patients. All the patients were hospital cases. As soon as the patient was in definite labor with regular pains and beginning dilatation of the cervix, the administration was begun.

Our patients fall into two groups. There were seventeen who received as the initial dose nine grains. As labor progressed a number received an additional six grains after about two hours; and a few of this number received an additional six grains in the latter part of the first stage.

The patients in the second group received as the initial dose fifteen or eighteen grains. The majority received the latter dose. One or

two additional doses of six grains were given as labor progressed in the majority of these cases. The results in this group have been tabulated under two heads: primiparae and multiparae. There were fourteen primiparae and nineteen multiparae in this group.

We were interested in this series to note the rapidity of action of sodium amytal orally, the efficiency of it in giving the patient relief from the pains throughout labor, the possible value of it in long and short labors, and finally, variations in susceptibility or idiosyncrasies which might prevent any routine scheme of administration being carried out. Our standard for efficiency was the production of a complete amnesia from the time the drug was administered.

No additional medication was given. It may be advisable in certain cases to combine the action of sodium amytal with that of morphine and magnesium sulphate, but we were anxious for our results to denote the single action of one drug. During labor we did everything to favor rest and sleep. All external stimulation was reduced as much as possible, examinations were reduced to a minimum, and the patient was allowed as much freedom as possible from disturbance.

The indication for additional administration after the initial dose was increasing severity of the pains with evidence of the labor lasting several hours longer and the observation that the maximum effect of the drug had been obtained. The additional doses were not given until approximately two hours after the initial dose.

Action.—An excellent result from the administration of sodium amytal orally was obtained only in patients in labor who received an initial dose of fifteen grains or more. In these patients the following effects were noted. Action of the drug was on the average noted in twenty-seven minutes, when the patient became very drowsy and slept between pains. The severity of labor at the time of administration was apparently a definite factor in the rapidity of action. Difficulty was encountered in measuring the time of the maximum effect, because of the fact that the increasing severity of the pains often masked the increasing action of the drug. At this time the patient usually slept between pains, but became aroused during the pain, squirming, often complaining of the pain, tossing about in bed, and in some cases assuming the crouching position. Immediately after the pain was over, the patient dropped back into sound sleep. This effect in the average cases was reached within forty-five minutes. When restlessness or alertness between pains and undue complaint of pains were noted, an additional dose was given. The general condition of the patient during this time was excellent. Skin was flushed and warm. No cyanosis was noticed. All reflexes were present. The patient could always be aroused by external stimuli, but often answered questions unintelligently and followed instructions poorly. There were no noticeable changes in pulse and temperature. In normal cases there was ob-

served only a moderate fall in blood pressure which in the majority
of cases did not exceed 10 mm. No evidence of gastrointestinal upset
from the oral administration was noted. Patients took their fluids
well and elimination was good.

Labor.—We have not noticed any prolongation of labor from the use
of sodium amytal. The average duration of labor has been: primip-
arae, first stage 13½ hours, second stage 41 minutes; multiparae, first
stage 4½ hours, second stage 16 minutes. The efficiency of the pains
has apparently not been decreased; in a few cases an apparent in-
crease was noted. Restlessness and excitement have been the most
untoward features of its use. Constant nursing supervision is neces-
sary for this reason. A few patients have become very excitable and
required restraint.

In the second stage it is impossible to get these patients to coop-
erate in "bearing down"; however, involuntary expulsive action oc-
curs with good result and our series show no increase in the length
of the second stage. A factor in the shortness of our second stage is,
no doubt, due to our practice of performing episiotomies early and
almost routinely in primiparae and of not hesitating to use perineal
forceps frequently.

Delivery.—The restlessness of the patient is often most annoying at
this time, when she may thrash about considerably and disarrange
the drapes and otherwise interfere with the smoothness of the deliv-
ery. This cannot be controlled by the administration of nitrous oxide,
for we have found that even small amounts of this caused the

TABLE I. CASES IN WHICH THE INITIAL DOSE WAS 9 GRAINS

CASE NUMBER	AGE	PARITY	P.P.	FIRST STAGE	SECOND STAGE	TERMINATION OF LABOR	TOTAL DOSAGE GRAINS	RESULTS
83812	24	i	O.D.A.	7ʰ 0ᵐ	0ʰ 50ᵐ	Spontaneous	27	Excellent (a)
84969	23	i	O.L.A.	11ʰ 40ᵐ	1ʰ 25ᵐ	Low forceps	9	Sedation
84717	22	i	O.L.A.	6ʰ 40ᵐ	0ʰ 47ᵐ	Episiotomy, low forceps	21	Sedation
84915	18	i	O.D.A.	11ʰ 25ᵐ	0ʰ 30ᵐ	Episiotomy, spontaneous	9	Sedation
84609	21	i	O.L.A.	1ʰ 20ᵐ	0ʰ 30ᵐ	Spontaneous	9	Sedation
84652	23	ii	O.L.A.	7ʰ 15ᵐ	0ʰ 15ᵐ	Spontaneous	9	Sedation
85610	37	v	O.L.A.	2ʰ 0ᵐ	0ʰ 4ᵐ	Spontaneous	9	Sedation
84879	28	iv	O.L.A.	4ʰ 30ᵐ	0ʰ 20ᵐ	Spontaneous	21	Fair
84875	18	ii	O.L.A.	1ʰ 55ᵐ	0ʰ 20ᵐ	Spontaneous	9	Sedation
80818	37	v	O.L.A.	2ʰ 0ᵐ	0ʰ 4ᵐ	Spontaneous	9	Sedation
84612	28	vii	O.L.A.	0ʰ 35ᵐ	0ʰ 4ᵐ	Spontaneous	9	No effect
82078	35	iii		4ʰ 0ᵐ	0ʰ 20ᵐ	Spontaneous	9	Sedation
84764	18	ii	O.L.A.	4ʰ 0ᵐ	0ʰ 35ᵐ	Spontaneous	15	Fair
84887	22	ii	S.D.A.	0ʰ 50ᵐ	0ʰ 20ᵐ	Spontaneous	9	No effect
84881	25	iii	O.D.A.	2ʰ 40ᵐ	0ʰ 15ᵐ	Spontaneous	15	Good
84623	29	ii	O.L.A.	7ʰ 0ᵐ	0ʰ 35ᵐ	Spontaneous	9	Fair
83868	38	ix	O.L.A.	14ʰ 25ᵐ	0ʰ 32ᵐ	Low forceps	21	Fair

(a) Patient received 15 grains (initial dose 9 grains and 6 grains later) prepara-
tory to insertion of Voorhees bag.

TABLE II. CASES IN WHICH THE INITIAL DOSE WAS 15 GRAINS OR MORE (PRIMIPARAE)

CASE NUMBER	AGE	PARITY	COMPLICATIONS OF PREGNANCY	P.P.	FIRST STAGE	SECOND STAGE	TERMINATION OF LABOR	TOTAL DOSAGE GRAINS	SUPPLEMENTAL ANESTHETIC	RESULTS
85002	20	i	0	O.D.P.	16h 0m	0h 25m	Spontaneous	27	250 gallons nitrous oxide	Excellent
85092	24	i	0	O.L.A.	15h 45m	0h 57m	Episiotomy, spontaneous	21	30 gallons nitrous oxide	Excellent
85152	17	i	0	S.D.A.	27h 20m	0h 10m	Breech extraction. Third degree laceration	21	100 gallons nitrous oxide	Excellent
85188	19	i	0	O.L.A.	5h 30m	1h 0m	Episiotomy, spontaneous	24	80 gallons nitrous oxide	Excellent
85327	20	i	0	O.L.A.	15h 35m	0h 20m	Midforceps, episiotomy	24	100 gallons nitrous oxide	Excellent
85238	28	i	0	O.L.A.	8h 30m	0h 15m	Episiotomy, low forceps	24	100 gallons nitrous oxide	Excellent
85094	17	i	0	O.L.A.	18h 35m	1h 31m	Episiotomy, spontaneous	30	35 gallons nitrous oxide	Excellent
85509	20	i	Preeclamptic toxemia	O.D.A.	10h 35m	0h 20m	Spontaneous	18	50 gallons nitrous oxide	Excellent
85534	16	i	0	O.L.A.	29h 0m (b)	0h 35m	Episiotomy, spontaneous	18	75 gallons nitrous oxide	Excellent
85505	26	i	0	O.L.A.	7h 5m	0h 27m	Episiotomy, spontaneous	30	No	Excellent
85638	16	i	0	O.L.A.	3h 30m	0h 25m	Spontaneous	18	100 gallons nitrous oxide	Excellent
85698	20	i	Preeclamptic toxemia	O.D.P.	2h 30m	1h 45m	Manual rotation. Low forceps	18	135 gallons nitrous oxide	Excellent
85008	39	i	0	O.D.P.	4h 0m	1h 13m	Spontaneous	15	112 gallons nitrous oxide	No results (a)
84800	24	i	Preeclamptic toxemia	O.L.A.	2h 50m	0h 55m	Episiotomy, spontaneous	15	75 gallons nitrous oxide	No results (a)

(a) Drug not given until patient was far advanced in labor.
(b) Drug not given until four hours before delivery.

pains to cease. We have therefore confined our supplemental inhalation anesthetic to the time of actual delivery and for the repair of lacerations and episiotomies.

The amount of anesthesia necessary has been greatly reduced. A smaller quantity of nitrous oxide and a higher concentration of oxygen have been the rule. This is taken smoothly by the patient. There is no cyanosis, vomiting, or postanesthetic discomfort. Ether has not been necessary. We do not know whether sufficient relaxation for a combined podalic version can be obtained from sodium amytal and nitrous oxide and oxygen. We have not had occasion to do one in this series.

There has been no increase in operative deliveries in our series. There have been 9 operative deliveries in these 50 cases; low and perineal forceps, 7; midforceps, 1; and 1 case in which cervical dilatation was completed with a Voorhees bag. In none of these cases did poor pains or prolongation form an indication. The low forceps extractions were done either in association with episiotomies out of respect for the pelvic floor or because of signs of fetal embarrassment. The midforceps delivery was done because of slight irregularity of the fetal heart.

Postpartum.—There have been no complications of the immediate or remote puerperium noticed. The uterus contracted firmly after delivery. There has been no postpartum hemorrhage. There have been observed no shock, chills, or marked changes in blood pressure, temperature, or respiration. The patient, as a rule, drops off into a quiet, restful sleep. The duration of sleep usually averages eight hours; she is usually drowsy for another four hours, after which she awakes quite alert, with no recollection of the entire labor, after the first administration of the drug. None of the following symptoms has been noticed: pulmonary edema, pneumonia, rash, itching, nausea, gastrointestinal upsets, headache, or gaseous distention. Elimination has been good. There has been no increased use of the catheter observed. Until the patient has reacted, there is need for constant nursing supervision.

Babies.—Babies at time of delivery are quite lively and cry readily. There has been no evidence of cyanosis or narcosis. Several of the babies delivered by forceps required a slight amount of resuscitation. Only one baby in the entire series died. Death occurred on the fifth day from hemorrhagic disease of the newborn. A study of the nursery records of these babies shows nothing abnormal in their nursery progress.

Results.—The results of our experience in the oral administration of sodium amytal to 50 unselected patients in labor are tabulated in three tables. Our results have been expressed as follows: *No effect; sedation,* where a slight drowsiness was noticed, but no analgesia or amnesia obtained; *fair,* where there was some slight analgesia and we felt as

Table III. Cases in Which the Initial Dose Was 15 Grains or More (Multiparae)

CASE NUMBER	AGE	PARITY	COMPLICATIONS OF PREGNANCY	P.P.	FIRST STAGE	SECOND STAGE	TERMINATION OF LABOR	TOTAL DOSAGE GRAINS	SUPPLEMENTAL ANESTHETIC	RESULTS
85095	31	vii	0	O.L.A.	4ʰ 5ᵐ	35ᵐ	Spontaneous	18	130 gallons nitrous oxide	Excellent
85087	22	ii	0	O.L.A.	4ʰ 30ᵐ	15ᵐ	Spontaneous	18	45 gallons nitrous oxide	No (b)
85010	35	x	0	O.L.A.	3ʰ 45ᵐ	7ᵐ	Spontaneous	15	Very small amount nitrous oxide	Excellent
85225	30	x	Preeclamptic toxemia	O.D.A.	8ʰ 30ᵐ	8ᵐ	Spontaneous	21	No	(a)
85276	23	iii	Preeclamptic toxemia	O.L.A.	2ʰ 41ᵐ	12ᵐ	Spontaneous	24	Very small amount nitrous oxide	Excellent
85299	38	viii	Preeclamptic toxemia	O.L.A.	11ʰ 20ᵐ	32ᵐ	Spontaneous	30	Very small amount nitrous oxide	Good
85387	26	iv	Preeclamptic toxemia	O.D.A.	2ʰ 35ᵐ	25ᵐ	Spontaneous	15	60 gallons nitrous oxide	Excellent
85462	23	ii	0	O.L.A.	6ʰ 0ᵐ	1ᵐ	Episiotomy, low forceps	24	75 gallons nitrous oxide	Excellent
85447	36	ix	0	O.L.A.	10ʰ 40ᵐ	5ᵐ	Completion of dilatation with Voorhees bag	30	110 gallons nitrous oxide	No (d)
85511	20	ii	0	O.L.A.	6ʰ 45ᵐ	5ᵐ	Spontaneous	18	No	Good (b)
85640	24	iii	0	O.D.A.	3ʰ 0ᵐ	15ᵐ	Spontaneous	18	20 gallons nitrous oxide	No (b)
85697	30	vii	0	O.D.A.	0ʰ 25ᵐ	10ᵐ	Spontaneous	18	Whiffs nitrous oxide for 5 minutes	No (c)
85748	24	v	0	O.L.A.	2ʰ 30ᵐ	17ᵐ	Spontaneous	18	40 gallons nitrous oxide	Excellent
85567	27	ii	0	O.L.A.	3ʰ 25ᵐ	40ᵐ	Episiotomy, low forceps	24	60 gallons nitrous oxide	Excellent
85015	22	iii	0	O.L.A.	1ʰ 25ᵐ	10ᵐ	Spontaneous	18	No	Excellent
85799	26	ii	0	O.D.A.	3ʰ 15ᵐ	4ᵐ	Spontaneous	18	60 gallons nitrous oxide	Excellent
69457	31	viii	0	O.D.A.	4ʰ 5ᵐ	35ᵐ	Spontaneous	18	130 gallons nitrous oxide	Excellent
85279	26	ii	Preeclamptic toxemia	O.L.A.	1ʰ 30ᵐ	2ᵐ	Spontaneous	18	60 gallons nitrous oxide	No (c)
85316	39	xiv	Preeclamptic toxemia	S.L.A.	0ʰ 33ᵐ	17ᵐ	Breech extraction	18	20 gallons nitrous oxide	No (c)

(a) Patient went into shock.
(b) Drug administered too late to give good effect.
(c) Rapid labor.
(d) Patient had definite resistance to sodium amytal; no effect at all noted.

though the patient was given moderate relief from the pains; *good*, in the cases in which the amnesia was not quite perfect and the patient remembered a few isolated facts about the labor; *excellent*, where the amnesia was perfect.

In the series in which the initial dose was nine grains, there were seventeen cases. Only one of these patients received an excellent effect. Here the patient received nine grains and an additional six grains preparatory to the induction of labor and, consequently, received fifteen grains before labor began. Another twelve grains were received during labor, making a total dosage of twenty-seven grains.

In our series of 14 primiparae who received an initial dose of fifteen or eighteen grains, 12 got excellent effect. The 2 patients in whom no effect was obtained were not fair trials, as both labors were rapid, one five hours and thirteen minutes and the other three hours and forty-five minutes. In both cases the drug was not administered until the patients had been in labor from two to two and one-half hours and the total dose was only fifteen grains.

In our series of 19 multiparae, who received an initial dose of fifteen or eighteen grains, excellent results were obtained in 10. In our 9 failures, 2 patients showed definite idiosyncrasy and will be discussed further. In 2 cases the results were good, the amnesia not being quite perfect. A further factor in one of these cases was rapid labor and late administration. In the other 5 cases in which the results were not excellent, the explanation lay in rapid labor and late administration of the drug.

Idiosyncrasy.—As mentioned, 2 of our patients showed definite idiosyncrasy.

One patient proved definitely resistant to the action of sodium amytal, although a total of thirty grains was administered and the initial dose was given sufficiently early. The labor lasted ten hours and forty-five minutes, during the period of which the patient was quite rational and described the labor afterward as her hardest.

Another patient with a moderate toxemia of pregnancy and a blood pressure at the onset of labor of 150/110 went into shock after a total administration of twenty-one grains, her blood pressure falling to 80/40. She required two intravenous infusions and ephedrin to restore her from this vasomotor collapse.

SUMMARY

1. Oral administration of sodium amytal in labor is probably just as satisfactory as by the intravenous route.

2. The difference of only a few minutes in rapidity of action when given orally as compared with the intravenous administration is not sufficient to influence its effect in labor, except in the most stormy labors.

3. The depth of narcosis depends rather on the dose employed than on the method of administration.

4. Labor has apparently not been prolonged nor have operative deliveries increased. No postpartum hemorrhages have occurred.

5. No untoward effect on the baby has been noted.

6. Marked variations in susceptibility occur and there may be definite idiosyncrasies. For this reason the patient should be carefully watched during the period of narcosis and blood pressure readings taken regularly.

7. Complete amnesia and a moderate amount of analgesia can be obtained in the vast majority of cases. The anesthesia cannot be relied upon.

8. The initial dose probably must be as large as fifteen grains and a total of thirty grains during labor may be administered with comparative safety.

9. Restlessness is probably the greatest drawback to the use of sodium amytal in labor and apparently occurs in the majority of cases. Our experience is that this is no more marked where administration is oral than where the intravenous route is chosen.

10. As this work is based on only fifty cases, further work is necessary to establish the proper dosage, method of administration, the desirability of combinations with other drugs, and finally, to evaluate its worth in the relief of the pains of labor.

REFERENCES

(1) *Shonle, H. A., and Moment, A.:* J. Am. Chem. Soc. 45: 243-249, 1923. (2) *Page, I. H., and Coryllos, Pol.:* J. Pharmacol. and Exper. Therap. 27: 189-200, 1926. (3) *Page, I. H.:* J. Lab. & Clin. Med. 9: 194, 1923. (4) *Hepburn, Latchford, McCormick, and McLeod:* Am. J. Physiol. 69: 555, 1924. (5) *Page, I. H., and Edwards, D. J.:* Am. J. Physiol. 69: 177, 1924. (6) *Cori, C. F.:* Proc. Soc. Exper. Biol. and Med. 23: 127, 1925. (7) *Britton, S. W.:* Am. J. Physiol. 54: 291, 1925. (8) *Underhill, F. P., and Sprunt, D. H.:* Proc. Soc. Exper. Biol. and Med. 25: 137, 1927. (9) *Mulinos, M. G.:* J. Pharmacol. and Exper. Therap. 34: 425, 1928. (10) *Hines, H. M., Boyd, J. D., and Leese, C. E.:* Am. J. Physiol. 76: 293, 1926. (11) *Deuel, H. J., Jr., Chambers, W. H., and Milhorat, A. T.:* J. Biol. Chem. 69: 249, 1926. (12) *Swanson, E. C., and Page, I. H.:* J. Pharmacol. and Exper. Therap. 31: 1, 1927. (13) *Zerfas, L. G., McCallum, J. T. C., Shonle, H. A., Swanson, E. E., Scott, J. P., and Clowes, H. A.:* Proc. Soc. Exper. Biol. & Med. 26: 399, 1929. (14) *Drabkin, D. L., Ravadin, I. S., Hirst, J. C., and Lapham, M. E.:* Am. J. M. Sc. 178: 379, 1929. (15) *Lundy, J. S.:* Proc. Staff Meet., Mayo Clinic 4: 225, 1929. (16) *Lundy, J. S.:* Anesth. and Analg. 8: 360, 1929. (17) *Lundy, J. S.:* Minnesota Med. 13: 223, 1930. (18) *Mason, J. T., and Baker, J. W.:* Surg., Gynec., and Obst. 50: 828, 1930. (19) *Baker, J. W.:* Bull. King Co. Med. Soc. 8: 408, 1929. (20) *Zerfas, L. G., and McCallum, J. T. C.:* Anesth. and Analg. 8: 349, 1929. (21) *McCallum, J. T. C., and Zerfas, L. G.:* Am. J. Surg. 8: 39, 1930. (22) *Robbins, A. R., McCallum, J. T. C., Mendenhall, A. M., and Zerfas, L. G.:* Am. J. Obst. & Gynec. 18: 406, 1929. (23) *Cullen, P. K.:* Indianapolis Med. J. 33: 356, 1930. (24) *Mason, J. T., Baker, J. W., Pilcher, F., Jr.:* Am. J. Surg. 9: 9, 1930. (25) *Mayo, W. J.:* Proc. Staff Meet., Mayo Clinic 4: 289, 1929. (26) *Lundy, J. S., and Osterberg, A. E.:* Proc. Staff Meet., Mayo Clinic 4: 386, 1929. (27) *Moore, J. H.:* Am. J. Obst. & Gynec. 19: 544, 1930. (28) *Massey, W. E.:* Texas State J. Med. 26: 241, 1930. (29) *Nielsen, C., Higgins, J. A., and Spruth, H. C.:* J. Pharmacol. and Exper. Therap. 26: 371, 1925. (30) *Eddy, N. B.:* J. Pharmacol. and Exper. Therap. 33: 34, 1929. (31) *Zerfas, L. G., and McCallum, J. T. C.:* J. Indiana M. A. 22: 47, 1929. (32) *Pearcy, J. F., and Weaver, M. M.:* J. Lab. & Clin. Med. 12: 1071, 1926-1927.

THE BERCOVITZ TEST IN PREGNANCY

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BERCOVITZ, in an address before the Section of Obstetrics and Gynecology of The New York Academy of Medicine on January 28, 1930, outlined certain "Studies on the pupillary reactions of pregnant and nonpregnant women and their practical application in the diagnosis of pregnancy." It occurred to one of us (A.J.G.) to try the Bercovitz test on a series of women attending the Prenatal Clinic of the Newark City Dispensary. As in all large prenatal clinics, a great many patients appear for examination because of suspected pregnancy and are later found to be not pregnant. It was decided to do the test on all the patients, pregnant and nonpregnant, in order to find out whether all pregnant women gave a positive reaction or at least what percentage, and whether the nonpregnant women were negative to this test. In other words, we realized that if the Bercovitz test proved reliable, we had at our disposal a diagnostic procedure for pregnancy, simple and not time-consuming as the Zondek-Aschheim test or some of the other widely used tests for pregnancy.

The technic as described by Bercovitz was used. One drop of 10 per cent sodium citrate solution was mixed with five drops of the patient's blood and instilled into the patient's right eye, the left eye being used as a control. As Wassermann tests are done routinely on all our prenatal patients, we had our technician withdraw an extra specimen of blood to be used for the Bercovitz test. This procedure obviated the necessity of subjecting the patients to the further annoyance of having their fingers punctured. The reaction sought was either a dilatation of the right pupil or a contraction, as compared with the control. This reaction, in positive cases, came on in from two to five minutes. We must emphasize here the point that Bercovitz makes, to examine the pupils of both eyes before making the test, so as to see whether the pupils are equal, the reason being obvious. The patient must be examined under a soft mellow light, as a light too bright or glaring would spoil the reaction. In our series the patient was instructed not to look at the light but at some fixed object in the corner of the room, the light falling on the patient's eyes.

The test was performed on 110 consecutive patients examined at our clinic. Owing to an error of our filing clerk twenty of the cards could not be obtained at the time of writing this paper, so for statistical

purposes the results in only 90 cases are reported. Only cases which gave a definite and clean-cut reaction are classed as positive. Those cases which gave a suggestion of a reaction are classed, "doubtful." Many of the "doubtful" reactions occurred in negro women, in whom, at times, it was very hard to read the pupil, particularly in those of a very black complexion. There is a great probability, in our minds, that many of these were actually positive. Those patients whose pupils apparently gave no semblance of a reaction were classed as "negative." All periods of pregnancy are represented, from four to six weeks to nearly term, besides those cases which upon examination were found to be not pregnant. In our series, no patient who was found to be *not pregnant* at the first examination or subsequent examinations gave a *positive* reaction, this agreeing with Bercovitz's findings as reported at the 1930 meeting of the A. M. A. Several definite cases of pregnancy gave negative reactions.

Total number of cases tested	110
Total number of cases reported	90
"Positive" reactions	58 (64.44%)
"Doubtful" reactions	13 (14.44%)
"Negative" reactions	19 (21.11%)

SUMMARY AND CONCLUSIONS

1. A statistical report of the Bercovitz test in pregnancy, based on 90 cases is submitted.

2. Of these, 64 per cent plus gave positive reactions, 14 per cent plus were doubtful, and 21 per cent plus were definitely negative.

3. All the nonpregnant cases gave negative reactions.

4. We believe that many of the "doubtful" reactions in pregnant negro women were probably positive, and would have been interpreted so in white women.

5. It is our opinion that the Bercovitz test is a valuable aid in cases where the diagnosis of pregnancy is in doubt. It is simple, quick, and can very easily be done in the office or large clinic.

273 ROSEVILLE AVENUE.
234 CLINTON PLACE.

THE TETANOID SYNDROME AND ITS RELATION TO MENSTRUAL CRAMPS

By E. C. Hartley, M.D., St. Paul, Minn.

IN A RECENT preliminary report[1] on the tetanoid syndrome in obstetrics the symptoms were described and a number of case reports given illustrating their clinical occurrence.

Five symptoms are included in the syndrome. They are cramp-like pains in the legs and thighs, an irritability of disposition unusual in the patient, insomnia, parasthesias of the extremities, and often an edema of the extremities apparently not associated with the heart or kidney pathology.

Tetany is described by Falta and Meyers as "an abnormally increased condition of excitement of the nervous system, which is demonstrable in a heightened excitability of the motor, sensible, sensory, and vegetative nerves, and under certain circumstances in parasthesias and bilateral intermittent, for the most part painful, spasms, with intact consciousness, or which become manifest through phenomena of irritation on the part of the vegetative nerves. To the picture of tetany belong also trophic and certain metabolic disorders. The manifestations are the result of an insufficiency of the parathyroid glands."

The classification of the syndrome is based upon its resemblance to the phenomena characteristic of tetany, and upon the reaction of individuals having such symptoms to the therapeutic agents used for the treatment of tetany. The relationship between the five symptoms and tetany was briefly discussed in the preliminary report referred to above.

The present paper reviews the incidence of such symptoms in a consecutive series of 240 pregnant women seen at the Wilder Dispensary over a period of one year. Although a few of the more severe cases have been treated, and a small number have been seen through labor and the puerperium, the chief concern throughout has been on the incidence of the syndrome and its possible relation to other factors. Each patient was questioned regarding the five symptoms, on the condition of the teeth, and on the menstrual history. Notes on treatment and on labor and the puerperium were made in a very limited number. The nature of the rôle played by calcium in these relationships, its chemical structure in metabolic processes, the significance of its influence upon capillary permeability, its function in the nervous system are the subjects of an extensive and rapidly growing literature; references to this literature are deliberately omitted since the purpose of this paper is to present a single clinical relationship.

A numerical value was assigned the various symptoms and they were graded according to their severity. There is a certain arbitrary value to these grades, but they are based on a scale which has been followed consistently. Thus, in grading cramps, the value 1 was given if mild cramps occurred in one extremity, 2 if in two extremities, etc.; if more severe, the value was multiplied by two. The same method was followed for edema and parasthesias. For insomnia and irritability the values were necessarily more arbitrary, but again, such as they were, they were followed consistently by a single observer throughout. The value 1 was given to either of these symptoms when the patient recognized a change from her usual habit in sleep or temper; the maximum value of 10 was given to those in whom an almost complete lack of control was shown even in the dispensary by fidgeting, weeping, and dwelling
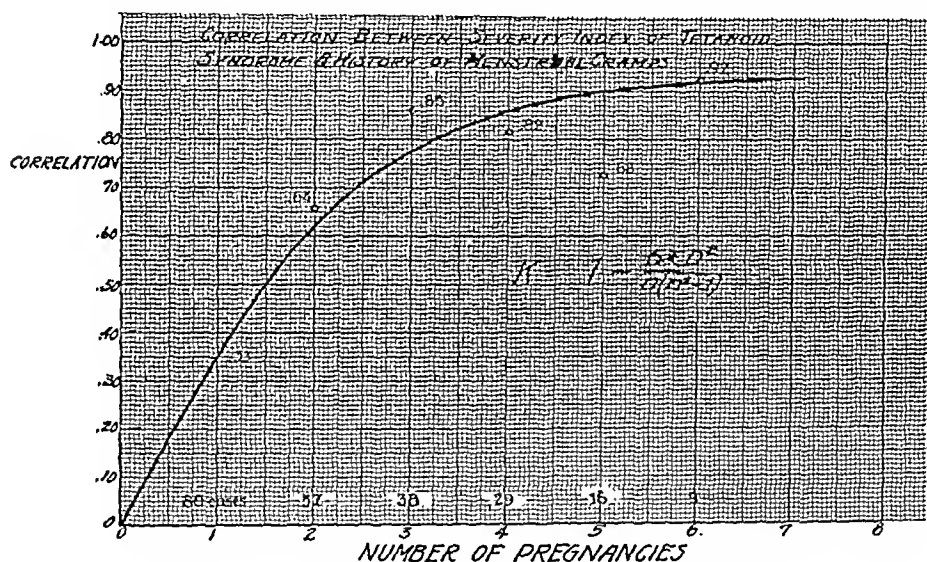
Fig. 1.—Curve showing increase of correlation with the gravidity of the patient.

upon rather pointless fears and anxieties. With the factor of pain during menstruation a maximum value of 10 was given to those who were forced to go to bed for several days at that time and who looked forward with dread to their periods; the value 1 was given when a patient had an occasional cramp to which she paid but little attention.

At the close of the year the case histories were grouped according to the gravidity of the patient into six groups. The number of those in the entire series who were gravid seven or more were too few to lend themselves to comparison.

For each patient a *severity index* was found by adding the values ascribed to the five symptoms in the syndrome. After arranging and classifying the various data, the factor menstrual cramps was chosen for comparison with the severity index for two reasons: first, because a question to the patient as to the presence or absence of cramps could be answered more definitely and with fewer qualifications than any

other, and secondly, because in looking over the assembled data there appeared to be a greater likelihood of finding a significant relationship in that factor. The coefficient of correlation was then found between the weighed factors severity index and menstrual cramp value according to the formula

$$K = 1 - \frac{6 \, \Sigma \, d^2}{N \, (N^2 - 1)}$$

In which K = the coefficient of correlation. $6 \, \Sigma \, d^2$ = the sum of the deviations between the rank order of the two factors squared, and N = the number of cases.

Correlation coefficients may range from a minus one to a plus one. A minus one shows an inverse relationship, zero indicates a complete absence of relationship, while a plus one value indicates a perfect cause and effect relationship. In speaking of this method of looking for relationship between sets of phenomena, Karl Pearson[2] says: Phenomena of any sort ''are contingent, and the problem . . . . is to measure the degree of this contingency, which we see lies between the zero of independence and the unity of causation.'' In the instance here given the degree of contingency as measured by correlation is high, and approaches the unity of causation. The word ''cause'' is used here not in the sense of a ''force,'' but in the sense in which John Stuart Mill defines causation as ''uniform antecedence.'' As expressing a high degree of antecedence, the coefficients here given have a routine and sequence indicating a clinical value.

Women in the first group (gravid one) have a coefficient lower than the rest, but still high enough to be significant of a definite dependence of the two sets of factors. This coefficient rises rapidly with each succeeding pregnancy to approach, but never reach, the unity of causation.

Considered from a clinical point of view, one would apparently be justified in telling a patient seen early in her first pregnancy, whose history showed that she had had menstrual cramps, that she would very likely suffer from one or more of the symptoms of the syndrome. For each succeeding pregnancy, having a similar menstrual history, one might expect these symptoms with enough confidence to warrant an early use of appropriate treatment as an anticipatory measure to prevent, if possible, the occurrence of symptoms otherwise practically inevitable.

REFERENCES

(1) *Hartley, E. C.:* Am. J. Obst. & Gynec. 19: 54, 1930. (2) *Pearson, Karl:* The Grammar of Science, chap. 4, Adam and Charles Black, London. The Macmillan Company, New York, 1911.

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PRIMARY CARCINOMA OF THE VAGINA IN A GIRL OF FOURTEEN

WITH A CONSIDERATION OF THE AGE INCIDENCE OF 905 CASES OF CARCINOMA OF THE UTERUS, VAGINA AND VULVA

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(From the Department of Obstetrics and Gynecology, University of Michigan)

PRIMARY carcinoma of the vagina at any age is uncommon, and below twenty is extremely rare. It is for this reason that this case is being reported.

Mrs. V. L., married, born February 28, 1914, entered the University Hospital as an emergency on November 21, 1929. Her family history was negative for cancer although her mother had been told she had a uterine tumor. Prior to the present illness the patient had always been well with the exception of the children's diseases. At the age of eight she injured the base of her spine by falling, and has complained of occasional pain in her spine since that time. She has lost forty-three pounds in the last year, weighing one hundred and twenty pounds on admission. Her menstrual life started at thirteen, regular at first, of twenty-eight day interval and lasting six days. She was married in November, 1928, and has had one pregnancy, terminated by cesarean section in July, 1929, the child dying nine hours after birth.

Her chief complaints were pain in the right hip, back, vagina and uterus; frequency and dysuria. Soon after marriage she complained of a bloody vaginal discharge and dyspareunia. In January, 1929, backache and pain in the vagina began. She was then two and a half months pregnant. She consulted Dr. H. L. Snyder of Winfield, Kansas who performed a biopsy which was reported as medullary squamous cell carcinoma. At that time the cervix was free, and the malignant process was confined to the right vaginal wall. Radium was administered by Dr. O. W. Swope, of Wichita, Kansas, but the patient did not return for further treatment.

Examination on admission revealed a well developed but poorly nourished girl. The skin was pale and dry, but otherwise general examination was negative. Vaginal examination was attempted without anesthesia, but was unsatisfactory. Under an anesthetic, the entire right side of the vagina from just within the hymenal ring to the vault was seen to be involved in a friable necrotic mass. Likewise the right side of the cervix and to a lesser extent the left, were involved. The right broad ligament was markedly infiltrated, and there was some involvement of the left. Biopsy again confirmed the diagnosis. The case was considered inoperable, and was treated with x-ray. Her condition gradually became worse and her weakness progressed. The bloody discharge became less and ceased. On April 26, 1930, she called the nurse to inform her that she was again bleeding. A few minutes later she was dead as the result of a massive hemorrhage. Autopsy showed that the malignant growth had completely destroyed the soft tissue in the right pelvis, the sacrospinous ligament being exposed. The right ureter was surrounded by the newgrowth with resultant hydronephrosis. No gross metastasis to distant organs could be seen. The most notable feature of the autopsy was the complete exsanguination of all tissues.

Through the kindness of Dr. Snyder, we were able to submit a slide of the original biopsy, together with our own, to Dr. Aldred Scott Warthin for diagnosis. Both of these he considered as medullary squamous cell carcinoma.

In 1919 Dr. Reuben Peterson[1] reviewed 500 cases of uterine cancer and analyzed them in reference to age. The incentive for his paper had been a case of squamous cell carcinoma of the cervix in a woman of twenty-one. To the above series 405 cases of carcinoma of the uterus, vagina and vulva have now been added from the Department of Obstetrics and Gynecology, University Hospital, from 1919 to 1929. These include only those cases that have been proved microscopically, and are by no means a complete list of the cases seen.

The age distribution of the 905 cases will be considered under the following headings: (1) Total number of cases, (2) carcinoma of the uterus, (3) carcinoma of the cervix, (4) carcinoma of the fundus,
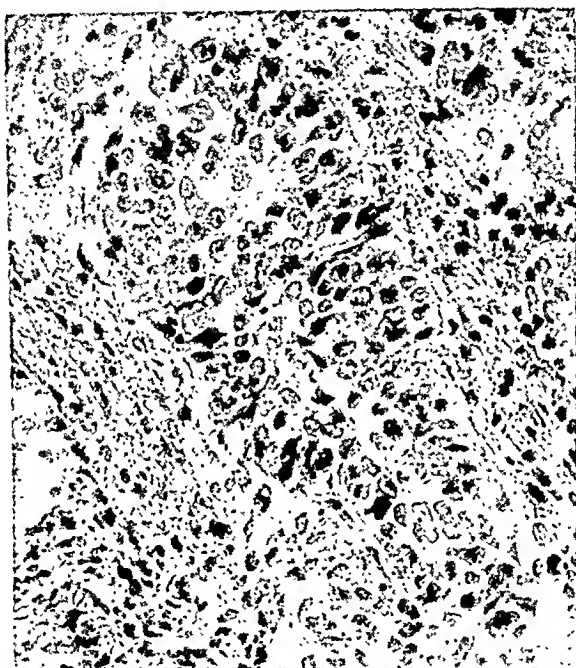
Fig. 1.—High power photomicrograph of specimen removed for biopsy.

(5) squamous cell carcinoma of the cervix, (6) adenocarcinoma of the cervix, (7) carcinoma of the vagina, and (8) carcinoma of the vulva.

The age distribution has been divided into five-year periods, the. first multiple of five being inclusive; for example, the period from 30 to 35 includes ages from 30 to 34 inclusive, but not 35, which is included in the next period.

Table I shows the age distribution of all 905 cases. The highest number of cases falls between 50 and 55, while 61.4 per cent occur between the ages of 40 and 60.

There were 867 cases of carcinoma of the uterus, both cervical and fundal, there being 722 cases of the former and 145 cases of the latter. Again the highest group is from 50 to 55. This series shows a slightly lower percentage of fundal cases than did Peterson's article,

mentioned above. However, Smith and Grinnell[2] found in 649 cases a ratio of 1 fundal to 4.46 cervical, while Koblank[3] reports a ratio of 1 to 10 and Mahle[4] in 855 cases found 30 per cent to be fundal.

In the cervical carcinoma, both squamous cell and adenocarcinoma, the maximum number of cases falls between 40 and 45, with 47.28 per cent between 40 and 55. If these cases are divided into their component groups one finds that the squamous cell variety still has the same age predominance, while the group of adenocarcinoma has an equal preponderance from 40 to 45, from 50 to 55 and from 55 to 60.

One would expect the fundal cases to have an older age selection which is borne out in the present series, 26.89 per cent being between 55 and 60. After 60 there is a sudden drop in the number of these cases. This series is unusual because of 14 cases under 40, as Donald and Shaw[5] in 177 cases found only one below 40.

TABLE I. AGE DISTRIBUTION OF 905 CASES OF CARCINOMA OF UTERUS, VAGINA, AND VULVA IN THE UNIVERSITY OF MICHIGAN HOSPITAL, CONFIRMED BY MICROSCOPIC EXAMINATION

AGE	TOTAL	UTERUS	CERVIX	FUNDUS	SQUAMOUS CELL CERVIX	ADENO-CERVIX	VAGINA	VULVA
10-15	1						1	
15-20								
20-25	11	11	10	1	8	2		
25-30	35	33	31	2	27	4	2	
30-35	61	60	57	3	55	2		1
35-40	104	101	93	8	86	7	1	2
40-45	146	141	127	14	118	9	3	2
45-50	127	124	110	14	104	7	1	2
50-55	152	145	119	26	110	9	1	6
55-60	131	128	89	39	79	9	1	2
60-65	75	72	50	22	47	2		3
65-70	44	36	25	11	22	4		8
70-75	8	7	4	3	4			1
75-80	9	8	6	2	6			1
80-85	1	1	1		1			0
Total	905	867	722	145	667	55	10	28

Only 10 cases of primary carcinoma of the vagina proved by microscopic examination have been seen in this clinic in the past 29 years. Of these, 3 occurred between 40 and 45, and 2 between 25 and 30. The present case is the only one under 25.

Of the 28 cases of vulval carcinoma the greatest number occurred between 65 and 70, there being 8 in this group; and 6 between 55 and 60. There were no cases below 30.

A careful review of the available literature has been made of all cases of carcinoma in the above locations, at or below the age of 20.

Bonner[6] in 1927 reviewed the literature for uterine carcinoma in the young, Rentschler[7] in 1929 wrote on epitheliomas of the vulva and included the young cases; Kehrer and Neumann[8] in 1929 considered both sarcoma and carcinoma of the uterus in children, and recently Morse[9] has discussed all cases below the age of 10.

Only 2 cases of primary carcinoma of the vagina at 20 or younger could be found. Ward[10] reported a case at 20, and stated that 2 cases had been reported at 14 and 17 respectively, but gave no references and these cases have not been located. He described his case as an epithelioma of the infiltrating type. The patient had complained of dyspareunia and vaginal bleeding. Heckford[11] in 1868 reported a case of medullary carcinoma of the vagina in a child of 10 months. An autopsy was performed, the report of which stated that there were villous looking growths protruding from and greatly distending the vagina.

There are 4 cases of carcinoma of the fundus that demand mention. The youngest was reported by Kehrer and Neumann.[8] This case was a child fifteen months of age. The authors describe the malignancy resembling a sarcoma for the most part, but with some alveolar structures resembling carcinoma. They conclude that the growth was a carcinoma, whose unripe cells showed a tendency to differentiate into structures varying morphologically. Taussig[12] reported a case of adenocarcinoma of the fundus at nineteen years, the diagnosis of which was confirmed histologically. Rössle[13] reported a case ten years of age, having a tumor the size of a child's head and occupying most of the pelvic and abdominal cavities. This was removed and even microscopically no adnexa could be found. There were metastases to the peritoneum, pleura, and diaphragm. He himself questioned the diagnosis, stating that the cells were embryonal in character and not like ordinary carcinoma cells and resembled ovarian carcinoma and the interstitial cell sarcoma of the testes.

Von Hansemann[14] reported a patient of Koblank's seventeen years of age. Curettage had shown a definite epithelial carcinoma of the body of the uterus.

The cervical cases below twenty are more common although the reports of several are not satisfactory. The youngest case is that of Bumm,[15] an adenocarcinoma at seven months. This patient was operated upon but died of pyelitis. Aschheim[16] confirmed the diagnosis microscopically. This same case has been reported by Bertkau[17] but is given as eight months.

Philipp[18] reported a case of Pfaundler's three and one-quarter years of age. She was healthy and strong but pieces of tissue had been passed from the vagina. These were diagnosed as adenocarcinoma and the uterus was removed. Durek diagnosed the condition microscopically as an endothelioma of the portio vaginalis and posterior vaginal fornix.

McDonald[19] and more recently Morse[9] have reported a case of adenocarcinoma of the cervix in a child of ten. This child had been admitted because of a gonorrheal vaginitis of two years' standing. The discharge had been bloody on two occasions. The abdomen was distended and there was tenderness over the bladder. There was a watery, blood-stained discharge associated with pieces of tissue. Vaginal examination revealed a soft friable mass on the cervix. Microscopically this proved to be an adenocarcinoma. An exploratory laparotomy showed that the uterus was five times normal size but it was impossible to remove it.

Glöckner's[20] case was reported by Margelsberg. This patient was seven years old and had had vaginal bleeding since the age of four. A radical panhysterectomy was performed and the upper one-third of the vagina was removed. She was free for four years and then developed inguinal metastases. The diagnosis of adenocarcinoma of the anterior cervical wall extending into the vagina was confirmed microscopically by Robert Meyer.

Ganghofer's[21] case at eight years also seems authentic. This child had had vaginal bleeding for two or three years. The tumor was the size of a hazelnut and projected into the vagina. The tumor was removed and Chiari reported the pathology as a medullary adenocarcinoma of the cervix.

Bonner[6] has reported an unquestionable case at thirteen years. The patient had previously been treated for "ovarian dyscrasia" and vaginal examination had been

neglected. The menstrual cycle had started at eleven years of age and was associated with pain in the lower left quadrant. When twelve years of age a thick cream-colored discharge appeared which persisted. Two months later she had a profuse vaginal hemorrhage, which was repeated. When first seen by Bonner vaginal examination showed a cauliflower type of growth the size of an orange, located on the cervix. This growth together with the entire infravaginal cervix was removed with a cautery and radium and x-ray administered. Nineteen months later there was no evidence of recurrence. The diagnosis of adenocarcinoma was supported by Lederer, L'Esperance, and Ewing.

Aguinaga[22] has reported a case of carcinoma of the cervix in a girl of fourteen years. Diagnosis was made by biopsy, but the type of malignancy is not mentioned. The tumor was removed, followed by cauterization and radium, and there were no metastases thirteen months after operation. Little[23] also reported a case of carcinoma of the cervix at the age of fourteen. It has not been possible to consult the original but references state that no histologic examination was made.

In 1926 Lisa and Cornwall[24] reported a case of squamous cell carcinoma of the cervix in a child of sixteen. There were metastases to the lungs, heart, spleen, and liver.

There are four cases reported at eighteen years, by Cragin,[25] Boyd,[26] Wells,[27] and de Rouville,[28] respectively.

Cragin's case was confirmed microscopically by Frances Carter Wood. This patient had had hemorrhages for several months, and a large cauliflower mass was found extending from the cervix. Biopsy was performed, followed by radical panhysterectomy. Four months later there was no evidence of recurrence.

De Rouville's case had had irregular metrorrhagia for six months. This had been associated with a discharge which had become fetid. For two months she had had vague pain in the lower abdomen. Vaginal examination revealed a vegetating tumor. Radical panhysterectomy was performed with apparent recovery at ten months. Microscopic diagnosis was an epithelioma of the cervix.

Boyd's case was presented in 1905. The patient was unmarried and had suffered from menorrhagia since the onset of her menstrual life, four and one-half years previously. Five weeks prior to admission the patient had noticed something protruding from the vagina, and the discharge which had been present became offensive. Examination showed a growth the size of a small walnut, attached to the anterior cervical lip by a broad pedicle. The cervix was amputated, and later the uterus and right ovary were removed per vaginum. The original pathologic report was adenocarcinoma but later was changed to endothelioma. The pathologic committee of the London Obstetrical Society reported that portions of the tumor resembled ordinary papillary adenocarcinoma, while other portions suggested that the growth began in the endothelium of the blood vessels.

Wells's patient had recently been married, her menstrual period had begun a few days late and then she had had profuse vaginal bleeding. A diagnosis of an abortion was made and a curettage was performed. This showed an adenocarcinoma at the level of the internal os. A radical vaginal hysterectomy was then done. The patient was reported as well four years later.

Eckardt[29] and Tschop[30] have both reported cervical cancer in individuals nineteen years of age. Tschop's patient had fallen downstairs four months before admission. This fall had resulted in loss of blood from the vagina and exhaustion. Following this the patient had noticed a discharge and small loss of blood when at stool. Examination showed that the larger portion of the cervix was covered by a dense irregular sensitive tumor. There were no metastases to the vagina or adnexa. The uterus was removed and the patient recovered. Diagnosis was confirmed histologically.

Eckardt's case was first considered as sarcoma, but finally called carcinoma. The patient's menstrual periods had been regular but profuse. A tumor the size of a child's head was found in the vagina attached by a pedicle to the cervical canal. The uterus was not enlarged.

An adenocarcinoma at twenty has been reported by Darnall.[31] The tumor, the size of a man's fist, was described as being of the cauliflower type and occurred in an unmarried negress. She entered the hospital because of a more or less constant flow and a sensation of fullness in the vagina. A panhysterectomy was performed. The patient died the same night of pulmonary embolism. The pathologic report was adenocarcinoma.

Gusserow[32] reported two cases of carcinoma of the cervix, one seventeen and one nineteen. The original reference states that these are the cases of Glatter and Beigel respectively.

Glatter[33] in a discussion of desirable death statistics mentions that between 1862 and 1869 in Vienna, one individual died at seventeen and one at twenty of carcinoma of the uterus. No further details are given. While Beigel[34] in a table of age incidence states that he has had one case of uterine carcinoma at nineteen but does not say whether fundal or cervical, and does not give any details.

Adams[35] reported a case of carcinoma at two and one-half years but the pathologic committee that examined the specimen considered it as a teratoma and not carcinomatous.

Engelhorn[36] refers to cases reported by Beigel at nineteen, Glatter [33] at seventeen, and Rosenstein[37] of the fundus at two, but does not believe that they have been proved satisfactorily.

The information concerning primary vulval carcinoma in children is very poor, and in addition, these cases seem to have been reported in the most unavailable literature.

Bietrix[38] has been given the credit for reporting the youngest case, in a child of eighteen months. Both Bietrix' original article and Popovitch's[39] reference fail to specify the exact type of tumor. However, Bietrix does state that the case was originally reported by Gaillard Thomas[40] who, one finds, described the growth as a sarcoma.

Kimoshita[41] has reported a case of epithelial cancer of the vulva in a fifteen-year-old child. This reference could not be obtained and consequently no further details are known.

Rothchild[42] in 1912, writing on the malignant newgrowth of the vulva and their prognosis, states that Merz[43] reported a case of carcinoma of the vulva at sixteen, Filcux one at five. Reported attempts to obtain Merz's original article have failed. Filcux's[44] case proves to be a sarcoma. Rothchild in a list of 331 cases of carcinoma of the vulva found one case between ten and fifteen and one case between sixteen and twenty.

Ossing[45] has reported a case of carcinoma of the vulva in a girl of twenty. Four months before admission she had been married. While on her honeymoon she first noticed a small painless tumor on the right labium. This tumor was removed two months later and a diagnosis of carcinoma made microscopically. When admitted, Ossing states that there was a deep crater-like scar in the middle of the right labium major. This was largely healed but was adherent to the bone. The edge was hard and infiltrated with nodules the size of lentils. The right inguinal glands were enlarged and tender. The inguinal glands, the right half of the labium, and most of the descending ramus of the pubes were removed surgically. The wound healed by primary union, but the patient died the same year.

Loorich[46] in reporting two cases of vulval carcinoma mentions that St. Germain had reported a case of carcinoma of the vulva in a child of five. A careful search has failed to reveal that St. Germain ever reported this case in the literature.

In this paper an attempt has been made to collect as many of the cases of carcinoma of the female genital tract below the age of twenty as possible. The result is necessarily somewhat incomplete due to the difficulties met in searching the literature. Nevertheless one is impressed by the number of authentic cases reported and one cannot fail to realize their significance and the importance of an early diagnosis by means of timely examinations.

REFERENCES

(1) *Peterson, R.:* Surg. Gynec. Obst. 19: 544, 1919. (2) *Smith, V. S., and Grinnell, R. S.:* AM. J. OBST. & GYNEC. 15: 832, 1928. (3) *Koblank:* Veits Handbuch 3: 2,672, 1908. (4) *Mahle, A. E.:* Surg. Gynec. Obst. 36: 385, 1923. (5) *Donald, A., and Shaw, W. F.:* Proc. Roy. Soc. Med. 22: 19, 1929. (6) *Bonner, A.:* AM. J. OBST. & GYNEC. 14: 175, 1927. (7) *Rentschler, C. B.:* Ann. Surg. 89: 709, 1929. (8) *Kehrer, E., and Newmann, H. O.:* Monatschr. f. Geburtsh u. Gynäk. 81: 68, 1929. (9) *Morse, A. H.:* AM. J. OBST. & GYNEC. 19: 520, 1930. (10) *Ward, G. G.:* Am. J. Obst. 57: 723, 1908. (11) *Heckford, N.:* Trans. Obst. Soc. Lond. 10: 224, 1868. (12) *Taussig, F. J.:* S. Clin. N. A. 5: 1437, 1925. (13) *Rössle:* Zentralbl. f. Gynäk. 36: 56, 1912. (14) *Von Hansemann:* Deutsche med. Wchnschr. 39: 1040, 1913. (15) *Bumm:* Deutsche med. Wchnschr. 35: 1331, 1909. (16) *Aschheim:* Ztschr. f. Geburtsh. u. Gynäk. 65: 216, 1910. (17) *Bertkau:* Berl. Klin. Wchnschr. 46: 1953, 1909. (18) *Philipp, P. W.:* Ztschr. f. Krebsforsch. 5: 326, 1907. (19) *McDonald, M. T.:* Yale J. Biol. & Med. 1: 151, 1929. (20) *Glockner:* Ztschr. f. Geburtsh. u. Gynäk. 63: 182, 1908. (21) *Ganghofer, F.:* Ztschr. f. Heilk. 9: 337, 1888. (22) *Aguinaga, A.:* Rev. de Gynec. et d'obst. 19: 247, 1925; Obst. Ber. 11; d. ges Gynäk. u. Geburtsh. 10: 386, 1926. (23) *Little, W. H.:* New Orleans M. & S. J. 49: 322, 1896-7. (24) *Lisa, J. R., and Cornwall, L. H.:* Proc. N. Y. Path. Soc. 26: 46, 1926. (25) *Cragin, E. B.:* Am. J. Obst. 67: 144, 1913. (26) *Boyd, F. N.:* Trans. Obst. Soc. Lond. 47: 313, 1905, 1906. (27) *Wells, B. M.:* Am. J. Obst. 67: 145, 1913. (28) *de Rouville, G.:* Bull. Soc. de'Obst. et Gynec. de Paris 1: 388, 1912. (29) *Eckardt, C. T., and Fraenkel, L.:* Arch. f. Gynäk. 30: 471, 1887. (30) *Tschop:* Juschnorusskaja Medicinskja Gazeta, 1896, No. 7; Zentralbl. f. Gynäk. 21: 59, 1897. (31) *Darnall, W. E.:* Penn. M. J. 24: 250, 1920. (32) *Gusserow, A.:* Deutsche Chir. 57: 211, 1886. (33) *Glatter, E.:* Deutsche Vrtljschr. f. Off. Gsndhtspfl. 2: 161, 1870. (34) *Beigel, H.:* Die Krankheiten des Weiblichen Geschlechtes 2: 507, 1875. (35) *Adams, J. E.:* Proc. Royal Soc. Med. 9: 45, 1916. (36) *Engelhorn, E.:* Beitr. z. Geburtsh. u. Gynäk. 13: 278, 1909. (37) *Rosenstein, S.:* Arch. f. Path. Anat. 92: 191, 1883. (38) *Bietrix, E. J.:* Exérésé Ganglionnaire Dau le Traitment Chirurgical du Cancer de la vulve, Paris, 1907. (39) *Popovitch:* Sur la treatment de l'epithelioma vulvaire, Paris, 1921. (40) *Thomas, T. G.:* Am. J. Obst. 7: 45, 1874. (41) *Kimoshita:* Med. Ges. in Tokio, 1907. (42) *Rothchild, M. F.:* Die Malignen Neubildungen der Vulva und ihre Prognose, Inaugural Dissertation, Freiburg, 1912. (43) *Merz:* 12 Fälle von Neubildungen der Vulva, Inaug. Dissertation, Berlin, 1885. (44) *Fileux:* Des tumeura malignes primitives de la vulva, Théses, Paris, 1902. (45) *Ossing, J.:* Ueber die Dauerresultate der in der Kieler Frauenklinik operierten Vulva Carcinome ans den Jahren, 1901-12 Inaugural Dissertation, Kiel, 1913. (46) *Loorich:* Zentralbl. f. Gynäk. 23: 657, 1899.

COMBINED PREGNANCY, WITH REPORT OF A CASE

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COMBINED or compound pregnancy are terms which have been employed in the literature to denote a coexisting intrauterine and extrauterine gestation.

Novak believes that the term "compound pregnancy" should be used in a limited sense in reference to a condition in which an active pregnancy occurs in the presence of the remains of a previous gestation, as for example, an intrauterine pregnancy complicated by a lithopedion, resulting from a previous gestation. For the purpose of study, a differentiation should be made in the classification between a combined and a compound pregnancy.

As is evident, combined pregnancy is primarily a twin pregnancy, one impregnated ovum lodging in the decidua of the uterine cavity and the other finding attachment usually to the tubal mucosa. In the process of growth, complications ensue, producing symptoms which may terminate one or both pregnancies and cause the death of the mother.

Fortunately, combined pregnancy is a rather infrequent condition, so rare that few of us have occasion to observe one or more than one such complication. Perhaps the symptoms are so mild in the early stages, the extrauterine pregnancy terminating spontaneously and completely, that sufficient clinical evidence of a combined pregnancy may be lacking. Furthermore, while the ectopic pregnancy is being diagnosed, the uterine pregnancy which may or may not be aborting concurrently, is likely to be overlooked. The literature records a number of instances of unexpected uterine gestations diagnosed during or after a laparotomy for an ectopic.

Since the question of superfetation in twin uterine pregnancy cannot in most instances be proved, it becomes increasingly difficult to diagnose such a condition in combined gestation, for here we are dealing with two fetuses, whose abode and nourishment are so dissimilar that it is quite impossible, even at or near term, to diagnose a superfetation. Physically and physiologically, a superfetation is possible, but the literature fails to record such a case.

Unfortunately many of the cases appearing in the literature give but meager histories. The authors, reporting the cases merely because of their rarity, stress the operative findings and the final results.

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In a mixed series of cases it has been found that the greatest incidence of extra- and intrauterine pregnancy occurred in women between the ages of thirty-one and thirty-five years (33 per cent), and that the second pregnancy was most susceptible to this complication (25 per cent). There is probably the same hereditary factor in multiple conceptions here as in other types of human pregnancies. Some of these patients give a history of previous twin gestation. It was further observed that the tendency to interruption of pregnancy for both the ectopic and uterine types occurred most frequently during the second and third months of gestation. For the uterine pregnancy, the occurrence at two months was 13 per cent and at three months 17 per cent, while for the extrauterine type at two months it was 23 per cent and 16 per cent at three months. Only 37 per cent of the uterine and 23 per cent of the extrauterine fetations came to term. The mortality rate for the mother was 21 per cent, the uterine fetus 61 per cent, and the ectopic 96 per cent.

Duverney, in 1708, was the first to report a combined pregnancy which he found at autopsy, death resulting from rupture of the tubal sac. In 1825, Mme. La-Chapelle recorded a case of a seven-month, premature, spontaneous, uterine delivery, followed by the maternal death on the fourth postpartum day. An autopsy revealed an ectopic. Parry, in 1876, collected 23 cases from the literature. Only in the last thirty years, however, has this type of multiple pregnancy been sufficiently assembled and reviewed. Zinke, in 1902, collected 88 cases, and, in 1904, appeared Simpson's paper with a review of 113 cases; this was followed, in 1907, by Neugebauer's notable monograph of 171 cases; and, in 1913, he increased the number to 244 cases. From 1913 to 1926 Novak was able to assemble 32 cases, while from 1913 to 1928 Stein collected 36 cases. In reviewing the last two papers, it was found that 18 cases were duplicated (due of course to the similar period covered by their reports), so that in a collective sense we have up to that time 294 cases of coexisting extrauterine and intrauterine pregnancy appearing in the literature. While only 294 cases have been reported up to 1928, by far the greater number has been either unrecognized or unreported. Since we are fully aware that many twin uterine pregnancies never develop to twin births, so likewise are many combined gestations overlooked, and result in a spontaneous resolution of the ectopic or merely an exaggeration of the uterine flow.

The symptoms vary, depending upon the duration of pregnancy and the location of the interruption. As has been stated previously, early conceptions, uterine and extrauterine, may terminate with little disturbance. The pelvic condition may be attributed to a mild adnexal involvement, an intestinal or urinary tract upset, a physical or mental overexertion, etc.; and so it proceeds unrecognized to spontaneous expulsion and in the ectopic type usually to absorption. But with the advancement of the pregnancy, the symptoms of termination become more pronounced, depending upon whether the uterus or the tube is the expulsive organ. If, however, both are active in the process of interruption, then the clinical picture truly becomes confusing, and unless we are on the alert, grave results may follow. Fortunately, such cases are very few in number and the ectopic explosive type predominates. The symptoms of an ectopic abortion and rupture are pathognomonic and need not be discussed here. It is necessary only to add that with a concomitant uterine pregnancy, the passing of a uterine decidual cast is lacking, and for obvious reasons there may be a complete absence of uterine bleeding if the uterine pregnancy is undisturbed. The lack of a uterine discharge at this time should arouse our suspicion of a possible undisturbed pregnant uterus; and, on the other hand, a profuse uterine hemorrhage with ectopic symptoms should warn us of a progressive abortion in a coexisting uterine gestation. With a uterine abortion and an undisturbed ectopic pregnancy, the symptoms are those of an ordinary abortion, except that there might be evidence of a greater external hemorrhage, due perhaps to the increased congestion in the pelvis plus the indirect

action on the myometrium from a growing extra-uterine fetation. If, however, the combined pregnancy has survived the more trying early periods and has reached a stage of viability, then the symptoms are practically the same as in a twin uterine gestation, except that there may be greater discomfort produced by the ectopic, resulting from its peculiar placental attachments, from a lack of a smooth muscular inclosure, and from adhesions to the surrounding organs.

Depending upon the symptoms, the diagnosis is made either early or late. The various subjective symptoms and physical findings of an acute explosion are familiar. The degree and type of uterine bleeding may assist us in reaching a proper conclusion. The stage of the combined pregnancy, with a uterus larger than the usual size of one associated with a simple ectopic, may likewise point to the actual condition. The greatest danger lies in cases showing predominating symptoms of a uterine abortion with only mild adnexal involvement. Only the most careful history and examination will save us from dangerous pitfalls.

If the combined gestation proceeds past the first trimester, the outlook for a viable fetus under favorable circumstances may be expected. Stein's statistics show that 43 per cent of uterine pregnancies are interrupted by the end of three months as compared to 53 per cent of the ectopics, while up to the seventh month an additional 15 per cent of the intrauterine and 18 per cent of the extrauterine fetuses are lost, and after the seventh month, 42 per cent of the uterine and 29 per cent of the heterotopic pregnancies terminate. We might assume, therefore, that a near majority of such twin fetuses delivered past the seventh month have an opportunity to survive. And yet, in looking through the literature we find only 9 cases where both fetuses were delivered alive. Of this number, only 3 cases showed both a living mother and two living children at the end of two weeks. Because of the rarity of such end-results and other interesting features, I wish to report the fourth such case of combined pregnancy, terminating in the third trimester, and resulting in two living children and a living mother. But before doing so, it might be advisable to discuss the treatment.

As in a simple ectopic, the indication for surgical interference in combined pregnancy in the early months is the recognition of the heterotopic pregnancy. At this time, the extrauterine conception is seldom diagnosed, unless symptoms of its separation become evident. Although in many instances the uterine pregnancy is not recognized preoperatively, the extirpation of the internal bleeding area must proceed, even in the knowledge of a coexisting uterine pregnancy, care and gentleness being employed in handling the impregnated uterus.

The uterine pregnancy is less likely to be disturbed in cases of tubal abortion, while a tubal rupture near the proximal end of the tube will usually effect a termination of the uterine pregnancy. The nearer the site of the tubal involvement is to the uterus, the greater is the possibility of a uterine interruption. If both pregnancies are in process of termination, a laparotomy preceded by a gentle curettage has been recommended. A curettement at this time seems to be a questionable procedure. If at all possible, a genuine conservative attitude in the management of the uterine abortion should be the method of choice. Some operators have attempted the removal of the ectopic disturbance by the vaginal route, proceeding through the pos-

terior fornix. In an uncomplicated ectopic such a procedure is difficult and unsatisfactory, requiring at times a laparotomy to complete the operation. With an additional uterine pregnancy, the vaginal route should be completely relegated so as not to disturb further the normal pregnancy.

A combined pregnancy in the later months of gestation with living fetuses and no symptoms of termination should be carefully observed in a well-equipped institution until viability is beyond question and then a laparotomy for the removal of both babies is probably the preferable procedure; although in undiagnosed cases, following a vaginal delivery and later recognizing a living ectopic, a laparotomy has been performed with the removal of a living baby. The literature fails to record an instance in which there was interference with the vaginal delivery by the extrauterine pregnancy, although the process of the uterine expulsion may somewhat affect the opportunity for a successful laparotomy later.

At the present time there is complete accord that a laparotomy is indicated for a viable heterotopic fetus, but there is some dissension as to the proper disposition of the abdominal placenta and membranes. Since in many instances the placenta is attached near the site of its original implantation, such as to the broad ligament, hemorrhage may be controlled during and after its separation by proper hemostasis of vessels in the broad ligament. When, however, such attachments are found to the intestines, region of aorta, liver, etc., the removal of the secundines becomes distinctly a very hazardous and unwise procedure, resulting in a high maternal mortality. In such instances it is advisable to ligate and cut the cord as close to the placental origin as possible and permit the placenta and membranes to remain in the peritoneal cavity. Some operators further advocate the closure of the abdomen without drainage. If infection does not occur, absorption follows in a comparatively short period of time. Others advise gauze packing of the amniotic sac, marsupialization of the sac to the peritoneal edges of the abdominal opening, and drainage.

In 164 collected cases of celiotomy in advanced ectopic pregnancy with a living child, Sittner draws the following conclusions:

30.7 per cent maternal mortality in cases of marsupialization of sac.
6.8 per cent maternal mortality after removal of placenta and securing blood vessels.
5.7 per cent maternal mortality after removal of placenta and sac.

The marked difference in the above maternal mortality rate would tend to give the impression that all patients should have complete removal of the secundines to improve their opportunity for recovery. It seems more likely, however, that the higher mortality is due to the unfavorable site of the placental attachment, preventing its separation

and removal, and therefore productive of more profuse bleedings and of more frequent infections. The mortality rate appears to be affected more by the location of the placental implantation than by the employment of any special method of treatment. On the other hand, if the fetus has been dead for some time, the placenta is readily separated and its removal is a very simple procedure, resulting in little or no hemorrhage.

In opening the amniotic sac for the removal of the fetus, the usual precaution is taken to pack off, so as to limit the escape of amniotic fluid into the peritoneal cavity. Usually oligohydramnios is present, although Lindfors, quoted by Blacker, reported an uncomplicated ectopic pregnancy in which there were 11 or 12 liters of amniotic fluid.

Fig. 1.—The ectopic fetus with flattening of left side of head, neck, chest, etc.

Fig. 2.—Shows more pronouncedly the deformities of both legs.

Because of the absence of the protective mechanism of the uterine muscle, the frequent lack of a sufficient amount of amniotic fluid, the pathologic encroachment of the embryo upon abdominal tissues and also the concurrent growth of the pregnant uterus, the extrauterine fetus frequently shows malformations, contractures, flattenings, depressions, etc., the head being most frequently involved. (See Figs. 1 and 2.)

There are many other interesting features of combined pregnancy which could be taken up for discussion, as for example the conservative treatment of ectopics; pathology of extrauterine pregnancy; the employment of the vaginal exploratory puncture, etc. The scope of this paper, however, will not permit of a discussion of these phases and so I shall proceed to the case presentation.

CASE REPORT.—Mrs. M. S., colored, entered St. Louis City Hospital on May 31, 1929, giving her age as thirty-eight years, born in Mississippi. She had two children aged thirteen and eleven years respectively. She had had no miscarriages, and there were no multiple pregnancies on either side of the family. She had never had any serious sickness. Her previous confinements were normal. Same husband for all the pregnancies. Her menses began at the age of ten, thirty-day type, nine days' duration, profuse, and no pain. Date of last menses was questionable. Her present condition dates from Dec. 26, 1928, when she had a severe pain in the left lower abdomen which necessitated her going to bed for several days. Following this attack, she spotted intermittently for a few days. She then noticed that her abdomen was enlarging. She firmly insisted that her menstruation was regular up to the early part of April, 1929. Owing to a poor mental state, not much reliance could be placed upon her statements. She was unaware of her pregnant condition until she came to the hospital. Examination then showed a fairly well-developed woman, weighing about 135 pounds, and 5 feet tall. Physical examination was negative except that there was almost a complete absence of teeth and a pendulous abdomen containing multiple masses. The diagnosis of a twin uterine gestation was made. One was a cephalic presentation (left occiput), engaging in pelvis, and the other was a transverse presentation with the head in left mid-upper abdomen, body above, extending to the right side.

She went into labor June 7 and delivered at 7:50 P.M., O.L.A., a premature (eight months) female fetus weighing 2200 gm. The birth of the second fetus was then awaited. When no further development in the progress of the second labor was evident, consultation was asked. I saw her about twenty hours after the first delivery.

Abdominal examination revealed a transverse presentation in the upper abdomen confirmed by x-rays and also distinct fetal heart sounds, to the left and above the umbilicus. Rectal and vaginal examination showed a puerperal uterus, empty of fetal contents, lying to the right and below, and a fetal mass to the left and above. A diagnosis of a combined pregnancy was made and a laparotomy was done under ether anesthesia. With the umbilicus as a central point, an incision 12 cm. long was made to the left of it. The fetal sac was evident only in a small area, the remainder being covered by adherent bowel and omentum. The visible point of the sac was packed off and then opened. About 10 c.c. of a fairly clear amniotic fluid escaped. A female fetus weighing 1420 gm. was delivered; the cord was clamped and cut. There were spontaneous respirations. We then attempted to explore. It was found that the placenta was adherent to the descending colon, and extended over toward the region of the spine, aorta, and small bowel. A gentle maneuver in the left upper pole of the placenta to find the degree of adherence produced such severe bleeding, that it was necessary to pack and repack, finally using a Mikulicz drain. The remaining cord was then cut short and after the amniotic sac was packed, the edges of the sac were sewed to the parietal peritoneum at the abdominal opening. The abdominal wound was closed in the usual way, permitting exit for the two packs. The postoperative course was somewhat stormy, but daily improvement was noticeable. On June 19, all packs had been removed and a gauze drain was inserted to keep the abdominal wound open for necrotic drainage. On July 3, twenty-four days after operation, placental tissue was in process of expulsion through the abdominal wound and was therefore extracted. Shortly thereafter the abdominal wound was completely healed and mother and both children were discharged from the hospital.

The extrauterine fetus showed the usual effects of an oligohydramnios as well as a lack of the protective mechanism of the uterine muscle. The parts of the fetus which were in approximation to the back of the mother evidenced a marked flattening, as for example the left side of the fetal head, left part of the neck, left

shoulder, etc. Likewise, the limitation of the size of the sac produced marked deformities of the lower extremities.

REFERENCES

(1) *Andrews, H. R.:* Proc. Roy. Soc. Med. Lond. 6: 1912-13. (2) *Blacker, G. F.:* Eden and Lockyer: New System of Gynecology, Lond., Macmillan 1: 417, 1917. (3) *Boldt, H. J.:* Med. Record, New York 91: 656, 1917. (4) *Center, C. D.:* Ill. Med. J. 19: 330, 1911. (5) *Curtis, A.:* Surg. Gynec. & Obst. 27: 232, 1918. (6) *Davison, F. W.:* Lancet 2: 1276, 1910. (7) *DuBose, F. G.:* South. Med. J. 8: 784, 1915. (8) *Ehrendorfer, E.:* Wien. klin. Wchnschr. 23: 42, 1910. (9) *Gerin-Lajoie, L.:* Canadian M. A. J. 20: 38, 1929. (10) *Hagens, N. M., and Moorhead, J. J.:* J. A. M. A. 40: 1440, 1903. (11) *Hirst, B. C.:* Penn. Med. J. 14: 950, 1910-11. (12) *Keyes, J. M.:* New York Med. J. 118: 611, 1923. (13) *Landau, T.:* Berl. klin. Wchnschr. 19: 330, 1911. (14) *MacFarlane, W. D.:* Glasgow Med. J. 84: 109, 1915. (15) *Neugebauer, F.:* Zur Lehre von der Zwillingschwangerschaft, usw. Leipz. Werner Klinkhardt, 1907. (16) *Neugebauer, F.:* Gynaek. Rundschau 7: 809, 1913. (17) *Novak, Emil:* Surg. Gynec. & Obst. 43: 26, 1926. (18) *Simpson, F. F.:* Am. J. Obst. & Dis. Wom. 49: 333, 1904. (19) *Sittner, A.:* Arch. f. Gynäk. 84: 1, 1908. (20) *Stein, Arthur:* AM. J. OBST. & GYNEC. 15: 159, 1928. (21) *Unterberger, F.:* Deutsche med. Wchnschr. 43: 1245, 1917. (22) *Zinke, E. G.:* Am. J. Obst. & Dis. Wom. 45: 623, 1902.

MISSOURI BUILDING.

SPONTANEOUS EVACUATION OF PYOSALPINX THROUGH THE UTERUS

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A CAREFUL search of the gynecologic literature at my command reveals reports of but two cases of rupture of a pyosalpinx by way of the tubal ostium into the uterus and thence into the vagina. One of these cases was reported by Edward Liell,[1] and the second case by Hammond.[2,3]

The comparative rarity of this satisfactory outcome in pyosalpinx, in which nature drains the accumulated pus for the surgeon, prompts me to call attention briefly to the condition and to report 2 cases from my clinical records.

That this condition is rare, there is no doubt. J. Bland Sutton[4] says that there is no trustworthy pathologic evidence that the discharges escape into the uterus by way of the tubes. Fulkerson,[5] Graves,[6] Kelly,[7] and Polak[8] make no mention of such possibilities. Anspach[9] says, "Under rare circumstances the pent-up pus, after reaching a certain degree of compression may be discharged through the uterine end of the tube into the cavity of the uterus. But this is not a frequent occurrence, for the infiltration of the tubal wall, the fixation and distortion of the tube which are incident to the inflammation, and the complicated peritonitis with adhesions and exudate usually block the uterine extremity."

CASE REPORTS

CASE 1.—Mrs. R. F., aged twenty-eight, widow, one child of twelve years, prostitute, first came under my observation on September 10, 1921, complaining of "pain and soreness iu the lower abdomen." Family and past history were irrelevant, except that during the previous winter she was confined to bed for two weeks with a similar complaint, which was diagnosed by the attending physician as "inflammation." Menses began at fourteen years, 28-day type, painless and regular until her illness the previous winter, since which time she has been markedly irregular, menstruating every two or three weeks with "severe cramping pains in the lower abdomen," only relieved after passing large clots. Last period ended one week before this examination, but recurred the day before.

The patient was in bed and appeared to be in pain. Temperature 99.6° F., pulse 80. Lower abdomen was slightly distended, rigid and tender, especially in lower portion. Vagina was of the relaxed marital type. Cervix was larger than normal, congested, eroded, and with a thick, blood-tinged tenacious discharge. Typical pelvic tenderness, with shortening and tenderness in both right and left fornices. A tender mass in the posterior culdesac displaced and immobilized the uterus forward and upward.

The patient was treated with rest in bed in semiprone position, elimination, ice bag, forced fluids, etc., until September 18 and irregularly at the office with tampons, etc., until February 28, 1922. She did not report for further treatment because she said she was feeling quite well.

She was next seen on February 18, 1924, complaining of pain in left lower abdomen that had been present for three days and had steadily grown worse. This had been the first recurrence of this pain since her treatment in 1922 and she had continued as a prostitute. The temperature was 103.2° F.; pulse was 100; her abdomen was distended, rigid and tender, the tenderness being most exquisite just above the symphysis in the middle line and to the left. On vaginal examination the cervix was found high in the vaginal vault against the anterior vaginal wall. There was well-defined bulging in the posterior culdesac, causing a marked vaginal shortening. The cervix was congested, reddened, eroded, and even slight movement elicited intense pain. The uterus and adnexa could not be defined. The protrusion was more marked in the left side.

The patient was again placed on palliative treatment. On February 20 she felt much relieved and temperature was 101° F. February 21 her condition was the same but temperature was 100° F. The next day the temperature had dropped to 99.8° F. February 23 she reported a restless night, with intense pain and high fever, but the following day the patient was much improved and temperature was 99.6° F. She remained in bed until March 17 with a temperature ranging from 100° F. to 99° F. and which finally became normal. Operation was advised during this quiescent period, but was refused by the patient.

On May 12, 1924, she was again forced to bed with the same syndrome of symptoms, except that the pain was more intense and radiated down her left thigh, with high fever, chills, and drenching sweats. On examination a temperature of 101° F. was noted, with increased tenderness and rigidity in the lower left quadrant. Protrusion into the vaginal pouch had increased since previous examination. The patient was treated palliatively until May 17, when it was noted that there was no improvement and she was getting progressively worse. Vaginal examination revealed that posterior bulging had increased, especially on the left side. There was marked induration of the vaginal wall and all the classic signs of pelvic abscess. Aseptic paracentesis of bulging mass showed pure pus. Posterior drainage was advised and urged and the patient consented to have it done the next morning. At 2:30 P.M. the same day, I was hastily summoned to the patient's

bedside and she informed me that she had experienced a sudden pain in her lower abdomen and felt something "give way" and shortly afterward a profuse yellow pus was discharged from the vagina with much relief of pain.

My first impression was that the pelvic abscess had spontaneously ruptured into the vagina. Very careful examination failed to reveal any rent in the vaginal wall. It was noted that pressure on the bulging posterior mass caused an increased flow of pus from the cervical canal. The cervix was cleansed and the canal aspirated, and time and time again the pus could be made to flow. Discharge continued for one week with progressive diminution in the posterior bulging and amelioration of the symptoms. Ten days later at the office pressure exerted with a sponge on a dressing forcep caused a flow of pus from the cervix. Smears showed numerous pus cells but no organisms. Recovery was rapid.

On April 5, 1926, she was given a bimanual examination and only a thickening of the posterior vaginal wall with some shortening in the posterior culdesac was found and she was quite free from symptoms. She was seen on the street about six months ago and informed me that she had not experienced any pain or discomfort and that her menses had been regular and painless.

CASE 2.—Mrs. E. B., aged thirty-five, Negro, domestic; first came under my care on March 3, 1921, for treatment for a "breaking-out" on her face and body. Past, family, and menstrual history were negative, except for a history of a suppurative inguinal adenitis on the right side, six years previously. General examination was essentially negative. She had a generalized miliary papular syphilide and her blood Wassermann was four-plus. Antiluetic treatment was arranged for, but the patient was not seen again until December 19, 1922. At this time she had an indolent, dirty gray ulcer on the inner side of the right leg about two inches above the internal malleolus. Her blood Wassermann was still four-plus. A course of six intravenous neoarsphenamine and twelve intramuscular mercury salicylate injections was given. The ulcer completely healed, but the patient did not report for further immediate observation or treatment.

She was next seen on September 2, 1924, complaining of "sickness of stomach, vomiting, and pain and tenderness in lower right abdomen." A diagnosis of subacute pelvic inflammatory disease was made and she was put to bed for two weeks with palliative treatment.

On December 1, 1924, the patient began another course of antiluetic treatments which was not completed. On November 16, 1928, the blood Wassermann was again two-plus and the patient was induced to take three intravenous neoarsphenamine injections.

She was not seen again until January 7, 1930, when she came to the office with a history of having been in bed for three weeks under the care of another physician for treatment for "pus-tubes." She complained that there were constantly present pain and tenderness in the lower abdomen, a profuse yellow discharge, and frequent, burning urination. Her last menses had ended two weeks previously after continuing for ten days.

Vaginal examination showed a marital outlet and both labiae bathed in a purulent greenish-yellow discharge. Stained smear showed gram-negative intracellular diplococci. The uterus was fixed in a mass that bulged into and markedly shortened the posterior culdesac. The cervix was congested, enlarged, ectropic, and eroded. Upon inserting and expanding the speculum blades, thereby exerting pressure on the posterior bulging, it was noticed that there was an increase in the discharge. The cervix and vagina were gently wiped dry and the speculum was again inserted, special effort being made to press the lower blade against the posterior bulging; again there was a discharge of pus from the cervix. The cleansing process was repeated with the speculum in place and pressure was exerted with a sponge on a

dressing forcep on the bulging and pus was seen to flow from the cervix. Smears from this discharge again showed an intracellular diplococci. This phenomenon could be repeated, even after aspiration of the cervix, again and again at subsequent visits until January 20. Patient was treated locally with mercurochrome-220 in 3 per cent solution. At each visit it was noted that the bulging was decreasing in size. Smear showed no evidence of gonococci on February 6. On February 25 all signs of active inflammation having subsided, a linear cauterization of the cervix was done in one stage.

She was last examined on April 5; the cauterized cervix had completely healed and there were no perceptible stigmas of gonorrhea in either the cervix, or in Naboth's or Skene's glands. The posterior bulging had entirely receded, and the uterus could be palpated but was immobilized and both right and left culdesac were somewhat shortened and other adnexa could not be palpated. The patient said that she felt fine.

REFERENCES

(1) *Lidl, Edward N.:* Am. Gynec. and Obst. J. 6: 305, 1895. (2) *Hammond, L. J.:* Am. Gynec. and Obst. J. 18: 130, 1901. (3) *Idem:* Trans. Philadelphia Obst. Soc., Jan. 3, 1901. (4) *Sutton, J. Bland:* Surgical Diseases of the Fallopian Tubes, Lea Bros. and Co., 1899. (5) *Fulkerson, Lynn L.:* Gynecology, P. Blakiston's Son and Co., Philadelphia, 1929. (6) *Graves, William P.:* Gynecology, W. B. Saunders Co., New York, 1916. (7) *Kelly, Howard A.:* Gynecology, D. Appleton and Co., New York, 1928. (8) *Polak, John O.:* Pelvic Inflammation in Women, D. Appleton and Co., New York. (9) *Anspach, Brooke M.:* Gynecology, J. Lippincott & Co., 1927, p. 362. (10) *Ries, Emil:* Am. J. Obst. & Dis. Wom. 60: 201, 1909. (11) *Curtis, Arthur H.:* Bacteriology and Pathology of Fallopian Tubes Removed at Operation, Trans. Am. Gynec. Soc., Philadelphia 46: 242, 1921. (12) *Idem:* Surg, Gynec., and Obst. 42: 6, 1926.

2321 EAST FIFTY-FIFTH STREET.

REPORT OF FATAL CASE OF CHEMICAL HYSTERECTOMY*

BY JOHN M. NOKES, M.D., NASHVILLE, TENN.

(Resident Obstetrician and Gynecologist, Vanderbilt University Hospital)

MRS. N. R., aged forty-three, admitted to the hospital, January 21, 1930. *Present Illness.*—Gradual cessation of menses during the past year associated with hot flashes and generalized weakness. One month prior to admission the patient had profuse bleeding which persisted to the time of admission. Biopsy from cervix, negative for carcinoma.

Past History.—Chronic cholecystitis with cholecystectomy in 1926. Mucous colitis, benign adenoma of thyroid, psychoneurosis associated with menopause.

Marital History.—Seven children living and well. Three abortions.

Pelvic Examination.—External genitals normal; moderate relaxation of vaginal outlet; mild laceration of cervix with free bleeding from the cervical canal. Uterus in normal position, slightly enlarged and freely movable. Right appendage palpable but not tender.

Laboratory Examination.—R.B.C. 4,100,000; W.B.C. 9,400; Hg. 62 per cent; sedimentation time eighty-five minutes; P.S.P. 75 per cent total output; urethral smear negative; cervical smear negative.

Clinical Diagnosis.—Hyperplasia of the endometrium.

Operation.—Under spinal anesthesia a dilatation and curettage was performed. After carefully covering the vagina with gauze saturated with sodium bicarbonate solution, the uterine cavity was packed with gauze which had been soaked in 50 per cent zinc chloride solution and wrung dry. Simultaneous with the packing, the patient began retching. This was associated with a sudden severe drop in blood pressure. The only complaint the patient had was a severe burning sensation over the bladder. Respirations became very shallow, blood pressure which was originally 140/70 dropped to 70/?. Ephedrine failed to elicit any response. The pulse became weak and thready and the patient assumed a mahogany hue. The uterine packing was removed with no improvement in the patient's symptoms. The patient was given saline with ephedrine intravenously but to no avail. There was complete circulatory failure with death.

COMMENT

This unfortunate case did not behave as did those cases of circulatory failure which we have occasionally seen during spinal anesthesia and our clinical impression was that circulatory failure was caused by the toxic action of zinc chloride. A series of dogs were injected intra-
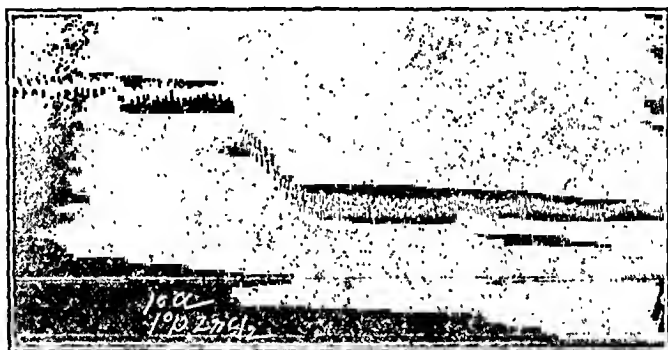
Fig. 1.—The sudden sustained drop in blood pressure due to injection of 10 c.c. of 1 per cent zinc chloride. Dog 11, February 7, 1930.

peritoneally with varying amounts of 50 per cent solution of zinc chloride. These animals failed to show any immediate toxic reaction from the injection and were autopsied at the end of forty-eight hours. As was to be expected the zinc chloride had exerted a corrosive effect on the abdominal viscera.

We believe, from these experiments, that the danger of immediate toxic symptoms resulting from the regurgitation of zinc chloride solution through the fallopian tubes is practically nil. It should be borne in mind that this may occur in practice and cause a chemical pelvic peritonitis and in the course of time may cause kidney damage of varying degree. Babcock[1] states that there is danger from both pressure injection into the sinuses and chemical peritonitis caused by distention of the fallopian tubes. Another series of animals were anesthetized with barbital, the carotid artery being exposed and connected with a mercury manometer. Femoral veins were exposed and varying amounts of zinc chloride were injected intravenously. Three c.c. of

50 per cent solution of zinc chloride caused an immediate fall in blood pressure and death resulted in a very short period of time. Smaller amounts, as low as 10 c.c. of 1 per cent solution, always caused a sudden, sensational drop in blood pressure but death in this group was not so sudden as when larger amounts were used. It seems that when the solution was allowed to enter the blood stream, toxic symptoms appeared. This patient was curetted for diagnosis and evidently the zinc chloride obtained entrance into the blood stream through the open veins in the uterus. For this reason if this particular agent is to be used, the uterine packing should be made very loosely and curettage should not be done prior to packing. In the original article by Masson[2] curettage prior to the packing of the uterus was not discouraged.

In reviewing the literature numerous references as to the toxicity of the solution and fatal cases are reported by Hofmeier,[3] Schmid,[4] Buttersack,[5] and others. Buttersack records the case of a patient who died sixty-nine days after treatment was instituted. This patient developed a nephritis, presumably as a result of zinc poisoning. Sollman[6] states that when zinc is given intravenously, its chief action is paralytic. The brain is first affected while the motor areas are not involved. Blood pressure falls rapidly, but this is owing to cardiac depression.

REFERENCES

(1) *Babcock, W. W.:* AM. J. OBST. & GYNEC. 7: 693-696, 1924. (2) *Masson, J. C.:* AM. J. OBST. & GYNEC. 10: 355-364, 1925. (3) *Hofmeier, M.:* Munchen med. Wchnschr. 2: 2379, 1907. (4) *Schmid, Max:* Monatschr. f. Geburtsh. u. Gynäk. 9: 860-862, 1899. (5) *Buttersack, P.:* Monatschr. f. Geburtsh. u. Gynäk. 29: 11-22, 1909. (6) *Sollman, T.:* Textbook of Pharmacology, ed. 3, p. 1022.

A NEW CANNULA FOR TRANSUTERINE TUBAL INSUFFLATION

By Mortimer N. Hyams,* M.D., F.A.C.S., New York, N. Y.

(From the Department of Gynecology, New York Post-Graduate Medical School and Hospital)

WITH improved methods of technic, transuterine tubal insufflation has become an accepted diagnostic and therapeutic method. The development of salpingography has made it possible to visualize the uterine cavity and the lumen of the fallopian tubes. Atresia of the oviduct prevents the passage of the media, and the exact site of obstruction is clearly defined in the salpingogram.

Until recently, tubal insufflation and salpingography were considered hospital procedures. Today, with the proper equipment, either may be carried out in the physician's office, with minimum economic loss to the patient.

The instruments heretofore used for insufflation are of rigid metal construction, curved slightly at the distal end, and varying in size from 12 to 20 French.

*Assistant Professor Gynecology.

The number of openings at the distal portion also vary, usually adapted to the diameter of the instrument.

The cervix is not uniform in size, shape, or consistency, nor is the uterus always in its normal anteverted position. Hence, the passage of a large rigid cannula into the cervix, through the internal os into the uterine cavity often results in considerable trauma to the cervix. Avenues of infection are opened for the microorganisms present in the vagina, thereby increasing possible morbidity by favoring the development of endocervicitis, parametritis, etc. Because of congenital or acquired abnormalities in the lumen of the cervix, internal os, or in the uterus itself, it is sometimes impossible to introduce a rigid instrument into the uterine cavity.

With these difficulties in mind, it seemed logical that the substitution of a flexible for a rigid instrument would be a step forward in technic. I have therefore devised an instrument which has overcome the previous difficulties and proved to be entirely satisfactory.
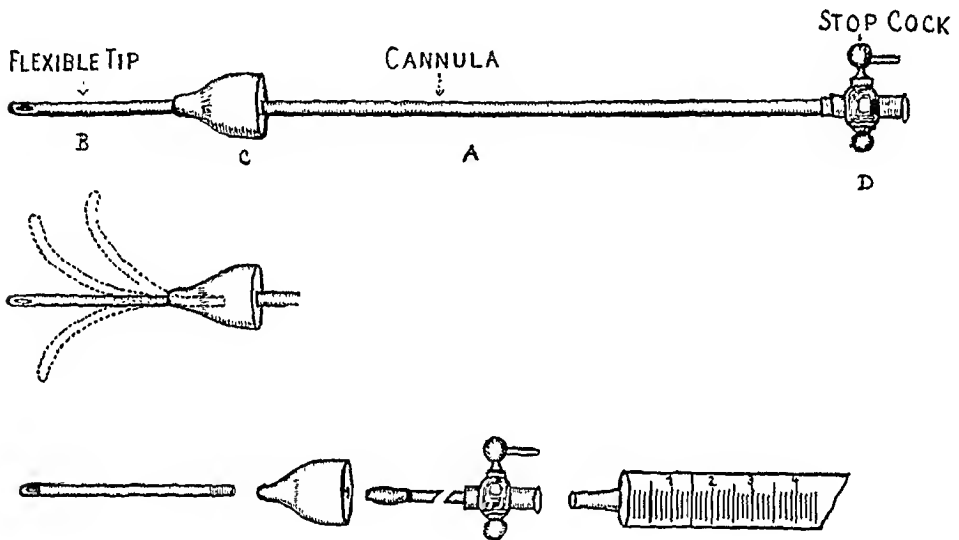
Fig. 1.

The instrument consists of a metal tube, A, a flexible ureteral catheter, B, a conical rubber irrigating tip, C, and a metal stopcock, D. The metal tube, A, is six inches long, size 12 French, threaded at its distal end to receive the catheter, B. This is a flexible ureteral catheter segment two inches long, size 9 French with a lateral and terminal eye, and screws tightly into the threaded end of tube A. The stopcock, D, is at the proximal end of the tube, A, and permits attachment of either a Luer syringe or a rubber bulb. The rubber tip, C, prevents leakage at the external os when the instrument is in use.

ADVANTAGES

1. The terminal portion of the instrument is semirigid but flexible.

2. The instrument may be used as part of any type of insufflation apparatus now in use.

3. By removing the rubber obstructing tip, it becomes an ideal uterine sound.

4. A minimum amount of trauma to the cervix is attended by its use.

5. Abnormal conditions of the cervical canal, internal os, or uterus cannot interfere with the passage of the flexible tip.

6. The flexible tip, being independent of the shaft, can be replaced when necessary.

78 EAST SEVENTY-NINTH STREET.

A SIMPLE METHOD OF VAGINAL ILLUMINATION

By Ned Shnayerson, M.D., New York, N. Y.

VAGINAL illumination by means of a light attached to a speculum requires a special fitting to the speculum or a bulky clip with a bulb which more or less obscures the field.
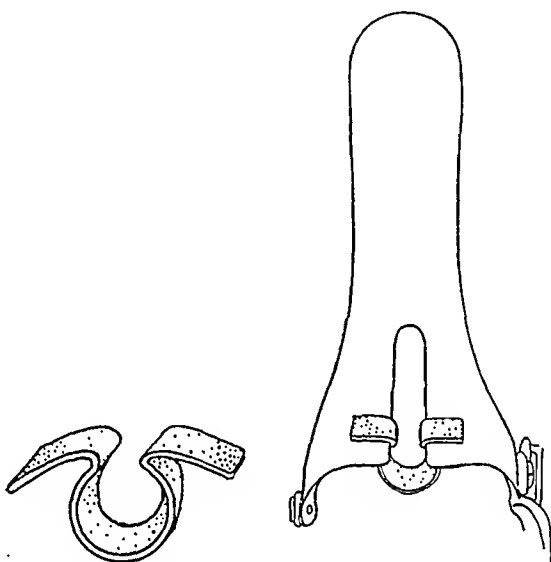
Fig. 1.   Fig. 2.

Fig. 1.—The clip itself; a cylindrical metal bar with its ends flanged to fit over the ventral blade of the speculum.

Fig. 2.—The clip as it is slipped into the ventral slit.

By taking advantage of the ventral slit in the speculum, I have devised a very simple clip which will support any illuminator of the Cameron type, in a bivalve speculum. The point of illumination occupies a minimum of space and affords clear and unobstructed vision, allowing the maximum space of a bivalve speculum for any vaginal procedure.

125 West Seventy-Sixth Street.

A SIMPLIFIED METHOD OF INTRODUCING THE CARBON DIOXIDE IN THE TUBAL PATENCY TEST

By Samuel Hanson, A.M., M.D., Stockton, Calif.

(From the San Joaquin General Hospital)

IN PERFORMING the Rubin test the direct supply of the carbon dioxide from a high pressure tank carries with it certain disadvantages. In the first place, a portable tank of the gas equipped with a siphon meter is not always readily available. Second, the control of the pressure and rate of flow, even with the aid of the proper mechanical devices, is rather inconvenient, and not entirely free from danger in the hands of the occasional operator. The high pressure
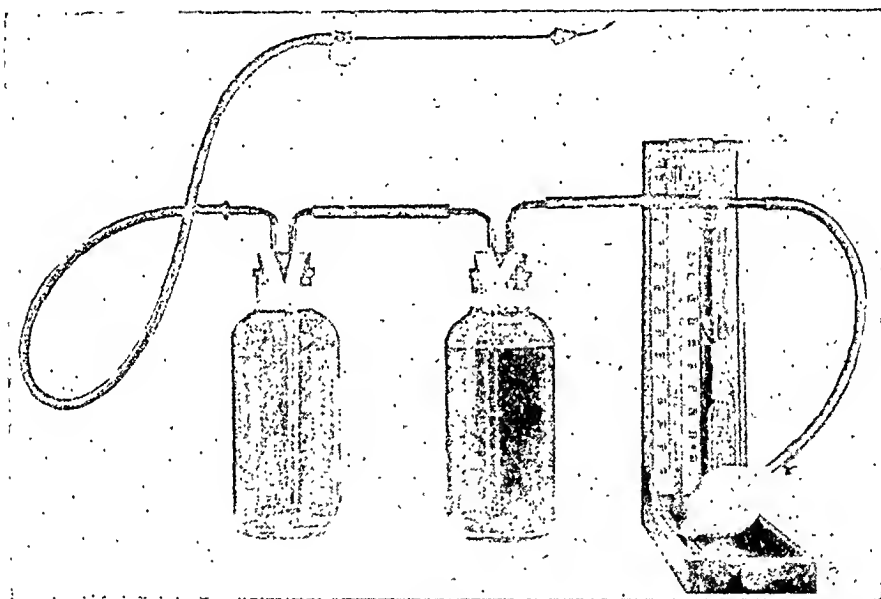
Fig. 1.

tank was devised for entirely different purposes. As a direct source of supply in the delicate tubal patency test it seems to be unwieldy and cumbersome.

The above considerations are not merely theoretical or personal; Furniss, Dickinson, Heaney and others have recognized the same difficulties, and have sought means to simplify the test by eliminating the high pressure tank.

It occurred to me that since the volume of gas needed is small the requisite quantity could be conveniently handled in a bottle under atmospheric pressure. The gas could be forced out of such a container by displacing it, under controlled pressure, with water saturated with carbon dioxide.

The only special equipment required for the method above referred to, consists of two 1 liter bottles with glass and rubber tubing connections. One of these bottles is filled with carbon dioxide gas, and the other with carbonated water (ordinary "soda water"). This very simple equipment can be easily assembled by a druggist, a clinical laboratory, or by the physician himself.

A readily available source of carbon dioxide is the common "soda fountain." From this supply the gas can be conveniently obtained as follows:

One of the bottles, equipped with the glass and rubber tubing, is filled with water and connected through its short tube with the nozzle of the soda fountain. The highly charged carbonic acid water is allowed to escape into the bottle until nearly all of the water is displaced by the gas. The carbon dioxide can be similarly obtained from a high pressure gas tank.

For the actual performance of the test the bottles, properly filled, are connected. A sphygmomanometer is attached to the bottle of water through a T tube, and a Keyes-Ultzman cannula is connected to the bottle of carbon dioxide, as shown in the figure. The tube leading to the cannula is clamped off, and the apparatus is tested for air-tightness by pumping air into the bottle of water with the rubber bulb, up to a pressure of 200 mm. If found satisfactory the apparatus is now ready for the insufflation.

Under the usual aseptic precautions the tip of the cannula is introduced into the cervix. The carbon dioxide is forced into the uterus by pumping air into the bottle of water. The pressure exerted is shown by the sphygmomanometer and the volume of gas introduced is indicated by the fluid level in the bottles. The rate of flow can be easily controlled by varying the pressure.

The interpretations are essentially the same as in the original Rubin test.

1009 MEDICO-DENTAL BUILDING.

A NEW STITCHING DEVICE

BY BASIL THOMPSON, M.D., C.M., TUCSON, ARIZONA

NOTWITHSTANDING structural improvement in needle holders, the suturing of traumatic and incisional wounds is still one of the most tedious and tiring processes in surgery.

The object of the suturing device, designed by myself, is to facilitate and accelerate the closing of wounds.

My invention relates to improvements in forceps for holding and manipulating surgical curve needles; a device consisting of two pair of surgical needle holders hinged together through their long plane as shown in Figs. 1, 2, and 3, and so con-

structed that the main forceps may be compressed in the fingers of the hand while the auxiliary shorter forceps may be compressed between the thumb and the palm of the same hand.

A curved needle of the proper dimensions may be inserted into tissues with the main forceps, following which the point of the needle is grasped by the jaws of the shorter auxiliary forceps, the jaws of the main forceps are released, and the needle is drawn through the tissues by the auxiliary forceps, thus completing the stitch.

Certain advantages of this suturing device are apparent; the mechanics of suturing may be accomplished with one hand, so that the other hand is available
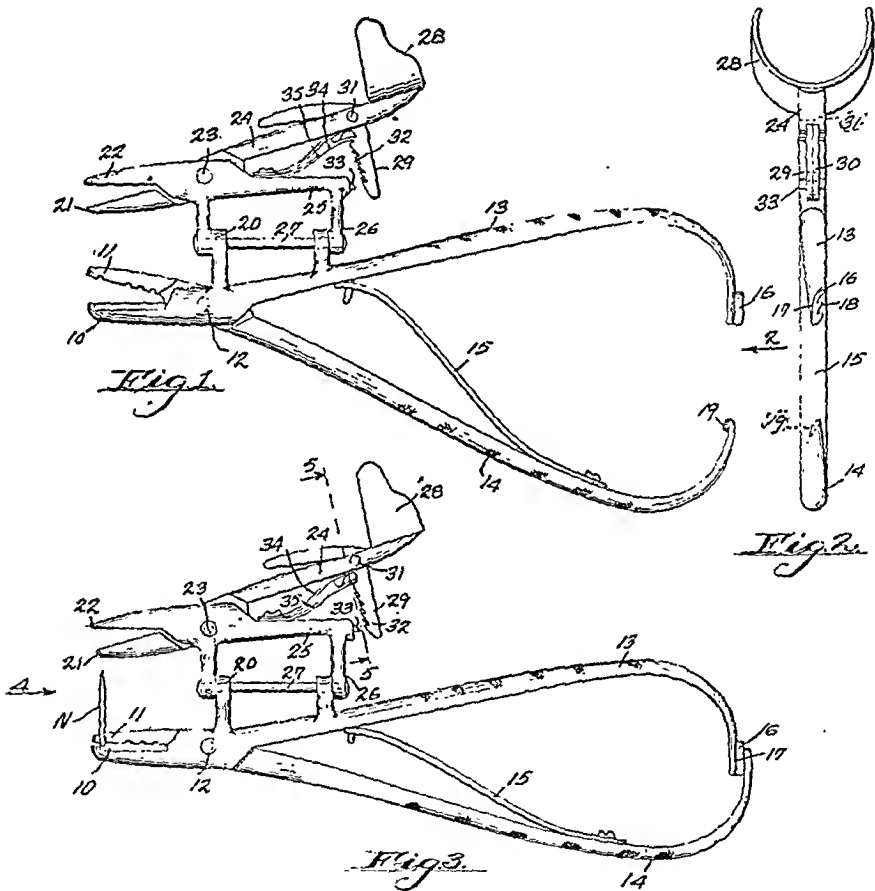
for sponging or other necessary acts, and an assistant is unnecessary for rapid operative work; second, in stitching with the needle holder, the needle is always held in the jaws of one of the forceps constituting the device, and is never free in the tissues, but is always under the control of the operator; third, in cavity work as during cervical repair where only sufficient field exists for one instrument to be used, this device itself completes the manipulations of stitching without its removal from the cavity, with a consequent saving in operating time. Instruments especially adapted to perineal, abdominal, ophthalmic, and pharyngeal uses, have been designed for these branches of surgery.

706 CONSOLIDATED BANK BUILDING.

Society Transactions

CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF JUNE 20, 1930

DR. CARL P. BAUER read a paper entitled, **Thymophysin in Selected Cases of Uterine Inertia.** (See page 411, March, 1931, issue.)

ABSTRACT OF DISCUSSION

DR. J. P. GREENHILL.—Dr. Bauer referred to the adverse criticism of thymophysin which was made by Dr. DeLee and myself in the last *Year Book of Obstetrics.* That particular comment was made by Dr. DeLee himself. I do not personally feel so condemnatory of thymophysin as Dr. DeLee does. Dr. DeLee bases his opinion upon a small personal experience with the drug and chiefly upon the view that thymus extract has no effect upon the uterus. If the latter is true, then Dr. DeLee is correct in assuming that thymophysin is nothing but pituitrin. However, Temesvary and two Swiss observers, Mueller and Del Campo claim to have demonstrated conclusively that thymus does have an effect on uterine muscle. I saw Dr. Temesvary in Vienna a few weeks ago and we discussed the use of thymophysin at great length because Dr. Temesvary was greatly disturbed by Dr. DeLee's condemnation which had been published in the *Journal of the American Medical Association.* Dr. Temesvary has statistics from many clinics concerning the use of thymophysin in thousands of cases without apparent harmful effects. The only adverse report I have seen in the literature is a case of rupture of the uterus. However, the author did not believe that the drug was entirely responsible for the rupture.

My own feeling about the use of thymophysin is as follows:

The drug should not be used for the induction of labor because it is generally useless. It should not be used during the expulsion or second stage because it may produce harm. The only indication I can see for its use is during the first stage of labor, namely the period of dilatation and only where a definite indication exists. By a definite indication I mean weak, irregular, or infrequent uterine contractions with little or no progress. I do not believe the drug should be given indiscriminately simply to shorten labor. Furthermore, in spite of the fact that Temesvary and others recommend whole cubic centimeter doses I have never given more than 3 minims at a time and I prefer to repeat this dose a number of times rather than give one large dose. In the third stage of labor, pituitrin is more effective than thymophysin.

DR. E. D. ALLEN.—I have seen two patients develop tetany in the second stage of labor so that they had to be delivered rapidly when the uterus went into tetanic contraction. Both babies were in poor condition when delivered. I would hesitate about giving this preparation in the first stage, before dilatation was complete. It seems to me on the basis of the atrophy of the thymus, that it would be rather surprising to have an effect on the uterus from a gland which undergoes atrophy in adult life.

DR. E. W. FISCHMANN.—We have used thymophysin in over 50 cases, mostly in the first stage, in both primi- and multiparae, with the result that labor pains were augmented somewhat with slight increase in frequency. In two or three cases, we have used it in the second stage of labor, and have seen no untoward results.

We have found it useful in cases in which we tried to induce labor by quinine and castor oil, where slight pains were set up which produced but little dilatation. After thymophysin was given, these slight pains became augmented, increased in frequency and in no case have we failed to secure complete dilatation. It has been our practice to use one-half ampule of thymophysin, and then if the fetal heart tones were good and rhythm not disturbed, the patient was given another ampule within an hour or an hour and a half. Very few cases required more than the half ampule. In our cases, we have seen no untoward results. We have seen no cases of tetany, no asphyxiation in the infant, and so far as we can see the preparation has worked admirably well in our cases and we hope it will continue.

DR. W. H. RUBOVITS.—If the term thymophysin were discontinued entirely in this paper, and in its stead were substituted the words pituitary extract, posterior lobe, everything that has been said might apply almost exactly. It is a discussion much as we indulged in long before thymophysin was heard of. I have had a rather interesting experience with these extracts. A couple of decades ago I was supplied with extract of posterior lobe, at which time we were instructed to administer this drug in 1 c.c. doses. I recall with a great deal of horror some things that happened. In one case the patient was sitting in a chair, in the first stage of labor. Within a few minutes after the injection the abdomen became board-like and the patient died. I delivered a live baby from a dead mother. In another case a multipara went very rapidly into the second stage of labor. She had merely a whiff of ether. She received ½ c.c. of pituitrin in the third stage of labor. When I went in to see her she said, "I am going to die," and in a few moments she did die. An autopsy was obtained and the cause of death was not determined, and I cannot say definitely that the posterior pituitary extract had anything to do with the death.

DR. N. S. HEANEY.—Dr. Bauer selected his cases because he wanted no confusion to exist as to the effect of his agent. The point brought out was that he gave thymophysin only when he was certain he had a primary inertia with the results that he has noted. Any remedy injected into the individual to produce uterine contractions cannot be expected to inaugurate rhythmic and regular contractions simulating labor pains, if the medium itself is the thing which brings about the uterine contractions. If at some time something is developed which will stir up the motivation in the individual gradually, and thus produce uterine contractions, we may then expect to get regular uterine rhythm. But when we inject one dose of a medium which will produce marked contractions of the uterus, we cannot expect it to act physiologically. We have had now our second introduction to a remedy which was said to be free of all difficulties. When pituitrin was introduced, it was said labor pains would be normal, and many papers were written substantiating the claims. So it is with this preparation, and we must accept other remedies in the future with skepticism.

DR. E. L. CORNELL.—I would like to issue a word of warning about this combination of drugs. It was supplied to me at the County Hospital and on a few of my private patients at the Lying-In Hospital. As Dr. Rubovits said, it puts one in mind of pituitary extract. The directions on the package called for 1 c.c. for the initial dose. I used ½ c.c. on the first patient and the pains were terrific. The patient yelled considerably and it necessitated the use of anesthesia to control the pains. Meconium appeared and the patient was not ready for delivery. When we started, she had about 5 or 6 cm. dilatation. We had to use gas throughout. She delivered in an hour and a half. In about the third or fourth case there were tetanic contractions of the uterus. The contraction lasted five minutes, when we put the patient to sleep under ether. Meconium appeared in the liquor, and I thought we were going to lose the baby. Lately I have been using it intranasally

in patients who had weak pains and no progress. The effect is usually just as good with the added advantage that you can withdraw the drug easily. Personally, I cannot see any difference between pituitrin and thymophysin.

DR. BAUER (closing).—I cannot answer the question about histamine. The reason for the publication of this paper is to report our experiences with thymophysin since our results are so different from those reported in the recent publication appearing in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY. We feel that thymophysin, like pituitrin, is seldom indicated in the first and second stages of labor and might be used to control hemorrhage in the third stage of labor.

DRS. R. D. TEMPLETON, IRVING STEIN AND SYDNEY SCHOCHET presented a paper entitled, **Studies in the Physiology and Pharmacology of the Human Vagina.**[*]

On examining the literature of the physiologic studies of the vaginal contractions it will be found that all the studies thus far have been made on laboratory animals. In a critical and exhaustive review of the literature on the motor activities of the vagina no references were found to physiologic or pharmacologic studies in the human species.

In this paper we present the results of a study of the vaginae in situ of 7 multiparous nonpregnant women. In 2 of the patients, tracings of vaginal contractions were made every second or third day throughout a menstrual cycle. Three of the patients were in the second decade, 2 in the third decade, and two past the menopause.

All of the experiments were carried out in the Mandel Clinic of the Michael Reese Hospital. The patients were placed in one of the quiet clinic rooms, the apparatus (kymograph and drum) shielded from the patients' view and they were permitted to be alone in the room. By this means external stimuli, which might alter the rate or character of the vaginal contractions were largely excluded.

The vaginal balloons were devised by one of us (Templeton) and consists of a condom divided into three compartments, arranged in tandem with a central core. Each balloon has a separate lead (rubber tube) which permits a tracing from each compartment on the kymograph drum. Each compartment was filled with air but not to the extent to distend or stimulate the vagina. Balloon number one was placed next to the cervix so that the third balloon was just within the introitus. All tracings were of two- to four-hour periods so as to eliminate the immediate possible stimulus effect of the introduction of the balloons.

DATA FROM NORMAL ADULT FEMALES

1. *Normal.*—All the patients studied exhibited spontaneous and rhythmic vaginal contractions. These contractions occurred every eight or ten minutes and originate in the upper end (cervical) of the vagina, and pass downward to the introitus. There are no differences in the rate of contractions in different parts of the vagina, but those near the introitus are of a lower amplitude. The contractions originate either in the vagina or uterus, and cannot be induced from stimulations in adjacent organs (bladder).

This method does not lend itself to the study of patients before the age of puberty. In women past the menopause the rhythmic contractions were absent. For the present we are reserving our studies of vaginal tracings during pregnancy, since this phase of the work is not completed.

Drugs: Hypodermic injections of 0.6 c.c. pituitrin and ergotoxin cause immediate response of the vagina (increase in the rate and amplitude) with but slight change in the tone.

INFLUENCE OF EMOTIONAL STATES ON VAGINAL CONTRACTIONS

Studies of vaginal contractions may be of practical value in the group of gynecologic patients who complain of vaginismus and frigidity, and for the physiologic studies of the vagina during pregnancy and labor.

SUMMARY

1. Spontaneous rhythmic contractions are present in the vagina of adult human females during the childbearing period and are absent in those past the menopause.

2. The rhythmic contractions are more marked during the week after the menstrual period (postmenstrual).

3. Vaginal contractions are not induced by contractions of an adjacent organ (bladder).

4. Pituitrin and ergotoxin cause increase in rate and amplitude of the vaginal contractions.

ABSTRACT OF DISCUSSION

DR. N. S. HEANEY.—There has been much said regarding the possible effects of operations disturbing the rhythmic contractions of the vagina. How has the effect of rhythmic contractions of the rectum been ruled out in these studies?

DR. SCHOCHET.—The purpose and object of presenting this type of work was the express purpose of emphasizing physiologic studies rather than the study of pathology. If more studies were carried out on the physiologic function of the generative organs, it might throw more light on the effects of surgery on the organs. These studies will lend themselves to two or three types of lesion in the generative tract, especially that group of women who come with so-called frigidity. We could determine whether they really are frigid. In checking up certain female hormones in animal work there is no indication that any drug has anything to do with increasing this function. In drawing conclusions as to the effects of a drug, we are either dealing with an elusive drug or with a psychic effect. The second group of lesions is that group with vaginismus. It may give us a means to localize the point of increased stimulation, whether it is due to nervous stimulation or a lesion in some part of the canal. The third reason is to see whether our so-called mechanical repairs are really repairing the vagina. We try to produce a condition which does not exist in the normal. The question is, how much vaginal repair are we doing? The chief repair or operation in which you want to establish physiologic function would be building up the perineal floor. That puts particular stress on the fascia of the vagina. Answering Dr. Heaney, the fact that the character of the contractions in the rectum is quite different would answer his argument. You do not have similar rhythmic contractions in the rectum.

Errata

In Dr. Cornell's discussion of the Symposium on *The Hemorrhages of Pregnancy,* page 427, April issue, the last word in the third paragraph should be "decreased" instead of "increased."

In the Case Reports of "Acute Puerperal Uterine Inversion," by Dr. Leonard C. Hamblock, in the March issue, page 435, in the second case report, twenty-first line of the first paragraph, the sentence "Episiotomy was required on seventh day, etc.," should read "Episiotomy was repaired on seventh day, etc."

Department of Reviews and Abstracts

Selected Abstracts

Anesthesia

Fermo, Cesare de: Experimental Studies on Anesthesia. Arch. ital. di chir. 25: 356, 1930.

Experiments performed by the author showed that all the anesthetics tested cause an alteration of the sugar-regulating mechanism in the sense of greater sugar-contents in the blood. The intensity and duration of such alterations, however, varied with the different anesthesias. With ether the change was rapid and intense during narcosis, reaching a value of 0.4 per cent to 0.8 per cent over the initial figure. There again is prompt lowering of the glycemia after the anesthesia is stopped, reaching 0.2 per cent to 0.35 per cent over normal. In 5 to 12 hours after anesthesia the blood sugar was again normal.

With novocaine the disturbance was brief, never going above 0.18 per cent to 0.23 per cent over normal.

The question of the cause of postanesthetic hyperglycemia is even now quite obscure in spite of many theories formulated.

SYDNEY S. SHOCHET.
JULIUS E. LACKNER.

Paroli: Viscero-Cutaneous Pain in Gynecology and Obstetrics and its Relief by Local Subcutaneous Anesthesia. Boll. d. Soc. Med. Chir. Bresciana, No. 1, 1929.

With 0.5 per cent solution of novocaine, the amount varying with the intensity of the pain, injected subcutaneously around a painful zone, excellent results were obtained in such cases as ovarian tumors, carcinoma of the cervix, etc. The pain disappeared for six to eight hours. No after-effects were ever met even with the use of large doses.

In women in labor, where cutaneous reflex pain was noted in the suprapubic abdominal, the lumbo-sacral and perineal zones, injections of novocaine around these zones resulted in complete relief in the first two areas, while no effect was obtained in the perineal zone.

This leads the author to think that in the cases in which this anesthesia yields a good effect the pain from the uterus is transmitted to the posterior horn of the medulla by the vegetative system and then passes to the skin, thus permitting subcutaneous anesthetization.

SYDNEY S. SHOCHET.
JULIUS E. LACKNER.

Arcieri: Anesthesia of the Frankenhäuser Ganglion and of the Internal Pudendal Nerve in Gynecology. Ann. di obst. 52: 176, 1930.

Anesthesia of the ganglion of Frankenhäuser and of the internal pudendal nerve, obtained with a 1 per cent solution of novocaine, is sufficient for all operations

that might be performed on cervix, vagina, and perineum. The technic of injection is simple and the results are good.

SYDNEY S. SHOCHET.
JULIUS E. LACKNER.

Halban, J.: The Control of Pain in Obstetrics and Gynecology. Wien. klin. Wchnschr. 42: 682, 1929.

Pain associated with conditions in the pelvis may be divided into: (a) pain during operative procedures; (b) during labor; (c) in gynecologic diseases.

During operative procedures the modern tendency is to use local anesthesia rather than general. Good results are obtained and 0.2 per cent tutocain is the ideal anesthetic.

In obstetrics ''narcose a la reine,'' sedatives during the first stage of labor, and scopolamin-morphine are recommended. Results with Gwathmey anesthesia have varied, so that its use is still debated. The avertin method, together with Martin's modification using scopolamin and narcophin, is still too recent and the results too divergent to permit its recommendation for general use. Anesthesia produced by the intravenous injection of somnifen and pernokton has been satisfactory but the efficacy of these substances is still uncertain. The author has used pernokton, 1 c.c. per 12.5 kg. body weight, slowly injected intravenously, and finds that results have been good. The anesthesia lasts 1 hour. Occasionally there have been periods of wild excitement following injection. Spinal, sacral, and pudendal anesthesia are uncertain, and hypnosis too highly specialized. The best and simplest method is the ''narcose a la reine,'' or the use of small quantities of ether with pains.

In gynecologic diseases the method used to control pain depends upon the condition. For inflammations, rest in bed and heat or cold are used. Heat may be in the form of hot air, diathermy, douches, thermophor, pelvitherm, gynotherm, etc. Diathermy is especially efficacious. Medications such as the antineuralgics, atropin, and the opiates are helpful. In backache, diagnosis is of primary importance followed by correct therapy. Paravertebral anesthesia to control pain has shown good results. This depends upon breaking the viscero-sensory arc by injection of the nervus communicans between the ganglion and spinal cord. The arc may also be broken by injections around the Head zones. The author has used this method and his results have been surprisingly good. He recommends it highly.

FRANK SPIELMAN.

Heim, K.: Local Anesthesia in Obstetrics and Gynecology. Monatschr. f. Geburtsh. u. Gynäk. 84: 45, 1930.

The author believes that local anesthesia has proved its usefulness in obstetrics and gynecology. He prefers lumbar anesthesia for abdominal operations and parasacral anesthesia for vaginal work. Other forms of local anesthesia such as the intravenous use of avertin and the use of perkain are likewise helpful. In perineal and minor vaginal operations, direct infiltration is sufficient.

Direct infiltration of the abdominal wall for the performance of cesarean sections deserves more attention than it has hitherto received. It may also be used for cases of adnexal inflammation where there are not many adhesions.

J. P. GREENHILL.

Oku, M.: Pudendal Anesthesia in the Domain of Obstetrics. Japanese J. Obst. & Gynec. 12: 361, 1929.

Oku employed pudendal anesthesia by the method of Gellert, Schmidt and Pribram in 100 cases and he believes that procedure is simple and harmless. It

removes all the pain associated with the second stage of labor. The muscles of the pelvic floor are completely relaxed and the second stage is frequently shortened. The number of episiotomies and perineal lacerations is diminished. If suturing is necessary, it is a painless procedure. This form of anesthesia permits forceps operations and breech extractions without producing pain. No disturbance in labor pains, placental separation, or contraction of the uterus is observed. Except for purulent inflammation at the points of injection and their neighborhood, there are no contraindications to this form of anesthesia.

J. P. GREENHILL.

Oku, M.: Painless Labor by Local Anesthesia. Japanese J. Obst. & Gynec. 12: 358, 1929.

The author used local anesthesia in the parametria by direct infiltration after the method of Gellert in 33 deliveries. The greatest defect in the type of paracervical anesthesia which he used was the shortness of its duration. Hence it is not very helpful for relieving pain in the first stage of labor. If given in the second stage, pain was eliminated in part or entirely in 80.7 per cent of the cases. The results were better in multiparas than in primiparas. Gellert and Pribram maintain that a large dose of pituitrin entails no risk when combined with the local anesthesia in the first stage of labor but Oku disagrees with this statement. However, he has seen no harm from the local anesthesia itself.

J. P. GREENHILL.

Cosgrove: Spinal Anesthesia in Obstetrics. Am. Jour. Surg. 5: 602, 1928.

Cosgrove extends the usefulness of spinal anesthesia in obstetrics by eliminating possible drawbacks through refinement in technic. Extreme lowering of blood pressure is guarded against by the administration of ephedrine ten minutes before injecting the novocaine. Fifty mg. of crystallized novocaine dissolved in 2.5 c.c. of spinal fluid are injected into the fourth lumbar space for obstetric vaginal operations and 100 mg. in the third lumbar space for obstetric laparotomies. Vomiting, depression, and headaches are less frequently observed and only one case in a series of four hundred had a persistent paresthesia. The advantages pointed out as of general application are enhanced in the hepatic and renal toxemias.

WILLIAM KERWIN.

Gautret: Three Cases of Rapid Labor Under Spinal Anesthesia. Bull. Soc. d'obst. et de Gynéc. 18: 215, 1929.

Three cases in which rapid dilatation of the cervix and quick delivery were performed under spinal anesthesia are detailed by the author. One patient was in labor at the time of the operation. In two cases delivery was accomplished in 20 and 25 minutes respectively. Lacerations of the cervix and perineum occurred in two cases.

J. P. GREENHILL.

Faugère: Artificial Dilatation Under Spinal Anesthesia. Bull. Soc. d'obst. et de Gynéc. 18: 199, 1929.

The author reports two cases and concludes that dilatation of the cervix under spinal anesthesia can easily and rapidly be performed. Version is not interferred with by uterine contractions and the author believes this form of anesthesia is superior to general anesthesia, especially chloroform, in serious cases.

J. P. GREENHILL.

Audebert and Estienny: The Action of Spinal Anesthesia on the Perineum of Parturient Women.   Bull. d. Soc. d'obst. et de Gynéc. 18: 98, 1929.

It is generally conceded that spinal anesthesia exerts a softening action on the perineum.   This action is definite but it is not constant.   Occasionally it does not prevent extensive perineal lacerations and not infrequently an episiotomy must be performed to avoid injury.   According to the authors, the action of lumbar anesthesia depends on the anatomic condition of the individual perineum.   They report 30 observations in which they employed this type of anesthesia for performing breech extractions, forceps operations, and pubiotomy.   In cases of forceps delivery, spinal anesthesia gives good results, in cases of breech extraction the perineum is in great danger of being lacerated and spinal anesthesia is the physiologic complement of pubiotomy for which it permits an extension of indications.

<div align="right">J. P. GREENHILL.</div>

Pistuddi: Forced and Accelerated Parturition in Spinal Anesthesia With Special Reference to the Method of Delmas.   Arch. Ostet. e Ginec. 17: 408, 1930.

The author after an accurate evaluation of the statistics of many authors and of his own personal experiences makes the following conclusions: It is true that in forced parturition or in attempts to accelerate labor and to hasten dilatation of the cervix, it is useful to protect the cervix from every reflex action, but to obtain this a spinal anesthesia is not necessary.   A general narcosis will do just as well when sufficiently deep.

The author believes that spinal anesthesia may be given preference to general narcosis especially in cases of hypercinesia and when it is desirable to influence the uterine retraction and contraction.

The author believes it would be better from now on, to speak of rachianesthesia and not of the method of Delmas.

<div align="right">SYDNEY S. SHOCHET.
JULIUS E. LACKNER.</div>

Metzger: Some Observations of Dystocia Labor Under Spinal Anesthesia.   Rev. Franç. de Gynéc. et d'obst. 24: 14, 1929.

Metzger has always felt that labor at a fixed hour was not a proper thing and his experience with this procedure in several cases of dystocia has justified his opinion.   Among five cases, one patient died of hemorrhage.   The author admits that spinal anesthesia produces relaxation of the perineum but he maintains that the same is not true of the body of the uterus or the cervix.   He has always held that dilatation of the cervix in a uterus which is at rest is impossible.   Spinal anesthesia produces not a relaxation but a hypertonicity of the body of the uterus.   If the uterus is normal and soft the cervix may be dilated rapidly but if the cervix is rigid, persistence in manual dilatation may result in rupture of the uterus.   Hypertonicity of the uterus manifests itself when attempts at version or forceps delivery are made.   Furthermore, when a cesarean section is performed under spinal anesthesia, the uterus is contracted and there is little bleeding.   The author experienced difficulty in all five cases in which he tried the Delmas procedure.

<div align="right">J. P. GREENHILL.</div>

Tassovatz, S.:   Spinal Anesthesia for the Low Cesarean Section.   Rev. Franç. de Gynéc. et Obst. 24: 350, 1929.

At the Woman's Clinic in Strasbourg, 56 low cervical cesarean sections were performed under spinal anesthesia.   In only two cases was there complete failure of

the anesthetic and in 50 cases the results were very good. In all of these cases the uterus was found to be well contracted when the abdomen was opened. The extraction of the child was easy and in 17 cases, the placenta separated spontaneously. The children cried immediately after birth. The postoperative recovery was smooth.

J. P. GREENHILL.

Edwards, George: Avertin Narcosis. Brit. Med. Jour. 2: 213, 1929.

The merits of avertin narcosis for operations are those of rectal anesthesia combined with those of deep preliminary and subsequent narcosis.

The dosage where there is no marked weakness or general infection is 0.1 gm. per kilo of body weight. Doses of 0.125 gm. and 0.15 gm. occasionally give trouble. The total dose is from 6 to 8 gm. The drug is provided in a concentrated solution with amylene hydrate, 1 gm. in 1 c.c.

Small quantities of inhalation anesthetics are usually necessary and it requires an experienced anesthetist to control the superimposed anesthesia. The amount of ether and chloroform used will be measured in drachms rather than ounces. The duration of the narcosis is from 1½ to 2 hours from the time of injection. Four hours from the start the patient is usually quite conscious of her surroundings.

When return to consciousness is prolonged the treatment consists of injections of lobeline, administration of CO_2 and O_2 mixtures and injections of ephedrine. During both the period of induction and that of recovery the relaxed jaw and tongue should be watched.

Avertin is contraindicated in diseases of the kidney, liver, colon, and where there is thyroid deficiency. It is excreted almost entirely by the liver and kidneys.

Morphine should not be used prior to injection.

During narcosis there is a fall in blood pressure of 10-20 mm. as occurs in deep sleep. There are no definite changes in the pulse rate. Breathing is shallow and the rate normal or slightly quickened. A slight cyanosis is usually observed.

G. E. HUDSON.

Naujoks: The Value of Avertin. Monatschr. f. Geburtsh. u. Gynäk. 84: 97, 1930.

The author does not believe that all the fatalities recorded as avertin deaths in the literature because they followed avertin anesthesia were due to this drug. Many of the deaths if not due to excessive doses or faulty technic were caused by defective constitution.

In obstetrics, avertin produces painless labor at the end of the first stage and during the second stage. It is the best narcotic for patients with eclampsia and is better than the Stroganoff treatment for this complication.

J. P. GREENHILL.

Connell, J. S. M.: The Use of Avertin in Childbirth. The Lancet 2: 184, 1930.

Avertin may be used in every case where antenatal examination indicates normal parturition, except when the presenting part is on the perineum. It may be used also while preparing for operative interference. Its usefulness is increased in primiparas. Avertin does not produce painless labor but it makes "things so easy for the patient."

The author encourages the general practitioner to give this analgesic agent a trial. This preparation is easily given, requires little apparatus, has no "afterresults," and is reasonably safe, although not entirely "foolproof."

H. C. HESSELTINE.

Fairbairn: Sedatives in Labor, Particularly "Twilight Sleep." Brit. Med. Jour. 1: 753, 1929.

The great number of labors which terminate in operative deliveries could be reduced materially by alleviation of the fatigue of mind and body. The author uses morphine gr. ¼ to ⅓ with hyoscine 1/150 in patients where the labor pains are well established and are causing a great deal of discomfort. He does not hesitate to use these drugs up to the time of complete dilatation of the cervix. If the second stage is not terminated promptly he recommends ½ cm. of pituitrin intramuscularly to be followed by low forceps in the event of failure of spontaneous delivery. The so-called "twilight sleep" or morphine-hyoscine narcosis is recommended for some cases to produce amnesia. An initial dose of morphine gr. ¼ and hyoscine gr. 1/150 is given and the hyoscine in 1/450 grain doses is repeated at frequent intervals until the amnesia is obtained. The narcotized baby which often results is not a cause for worry.

M. EDWARD DAVIS.

Jennings, David R.: Hyoscine Amnesia in Labor. Brit. Med. Jour. 2: 801, 1929.

This is a record of 24 cases treated by hyoscine alone, throughout the first and second stages of labor. It consists in giving 1/100 gr. of hyoscine as soon as labor is fairly started. Thereafter two more 1/100 gr. at half hourly intervals followed by similar injections of 1/100 gr. every two hours as long as labor lasts.

The effect of the drug becomes moderately noticeable after the second half-hourly injection. There is a sharper distinction between the actual pains and the period of quiescence. The former is characterized by a period of restlessness, while the latter is spent in quiet sleep. There is a slight cyanotic flush which is more noticeable during a pain. The pupils become dilated and the lips and tongue dry. The voice is rarely raised above a moan or subdued muttering. The memory test is usually lost after the third injection, and remains so until the end of labor. Loss of recognition test, of an object such as a pen may occur, but unless this happens early or the condition is associated with deep unconsciousness and stertorous respirations the hyoscine should be continued. Should the pains weaken, the next injection should be deferred until they are again satisfactory. Catheterization may be necessary. Large patients may require restraints. Two patients in this series showed hallucinations after the delivery of the placenta. None were found intolerant of the drug.

Complete amnesia was obtained in 20 cases and the incidents remembered by the remaining four were few.

All babies were born alive. The third stage was normal in all cases, average duration being 15 minutes 12 seconds, and loss of blood about 5⅔ oz.

G. E. HUDSON.

Gwathmey, James T.: Obstetrical Analgesia. Surg. Gynec. & Obst. 51: 190, 1930.

Inasmuch as "Obstetrical Analgesia" never reaches full surgical anesthesia, and was employed by the inexperienced during the period of its development, there is no good reason why it should not continue to be used by them as well as by the expert obstetrician. If mistakes are made no harm can result to either mother or child. It simply alleviates the pains of childbirth, with no increase in stillbirths, and with no interference in any way with the normal processes of labor.

The medication varies in its results from a light sedative effect to analgesia with unconsciousness and amnesia. The progress of labor is not delayed. Oc-

cipitoposterior positions rotate in about the same proportion as in normal labor. Postpartum hemorrhage is less than with any inhalation method. If anything, the use of forceps is decreased. Statistics show that the incidence of forceps delivery has been reduced over 50 per cent since the method has been used.

Increased success will come with experience. Those who take the trouble to explain to the patient and thus secure her cooperation will obtain better results than those who administer drugs in a mechanical manner.

The standard method consists of three intramuscular injections of magnesium sulphate, each of 2 cubic centimeters of a 50 per cent solution, an injection of morphine sulphate, ¼ grain given with the first injection of magnesium sulphate only and a rectal instillation of a solution consisting of:

Quinine alkaloid	gr. 20
Alcohol	min. 40
Ether	oz. 2½
Petrolatum liquid or olive oil q.s.ad.	oz. 4

In prolonged labor this complete technic in many cases may be repeated twice and occasionally three times without detriment to either mother or child.

WILLIAM C. HENSKE.

Books Received

TEXTBOOK ON THE NURSING AND DISEASES OF SICK CHILDREN for Nurses and Welfare Workers. Edited by Alan Moncrieff, medical registrar and pathologist to Hospital for Sick Children, London. With 111 illustrations. New York, G. P. Putnam's Sons, 1930.

LECTURES UPON THE NURSING OF INFECTIOUS DISEASES. By F. J. Woollacott, senior assistant medical officer, Grove Hospital, London. New York, G. P. Putnam's Sons, 1930.

TEXTBOOK OF ORTHOPAEDIC NURSING. By Evelyn C. Pearce. New York, G. P. Putnam's Sons, 1930.

GYNAECOLOGY FOR NURSES AND GYNAECOLOGICAL NURSING. By Comyns Berkeley, gynecological and obstetric surgeon to Middlesex Hospital, etc., etc. Revised and enlarged edition. G. P. Putnam's Sons, New York, 1930.

ABDOMINO-PELVIC DIAGNOSIS IN WOMEN. By Arthur John Walscheid, director of obstetrical and gynecological department of Broad Street Hospital, etc., etc. With 397 illustrations and one color plate. St. Louis, C. V. Mosby Company, 1931.

AN INTRODUCTION TO GYNECOLOGY. By C. Jeff Miller, professor of gynecology, Tulane University School of Medicine, etc., etc. Illustrated. St. Louis, C. V. Mosby Company, 1931.

CANCER. Its Origin, Its Development, and Its Self-Perpetuation. A research by Willy Meyer, consulting surgeon of the Lenox Hill and Postgraduate Hospital, New York, etc., etc. New York, Paul Hoeber, Inc., 1931.

DAS GYNAEKOLOGISCHE SEMINAR. Praktische Gynaekologie in 15 Vorlesungen. Dr. Wilhelm Liepmann, Universitaetsprofessor, Direktor des Deutschen Instituts fuer Frauenkunde, etc. Mit 305 zum Teil mehrfarbigen Abbildungen im Text und auf 24 Tafeln. Urban & Schwarzenberg, Berlin und Wien, 1931.

GYNAEKOLOGISCH-GEBURTSHILFLICHE TASCHENHEFTE fuer den praktischen Arzt. Von San. Rat Dr. Karl Abel, Berlin. Verlag von Otto Enslin, Berlin, 1931.

PHYSICIAN'S MANUAL OF BIRTH CONTROL. By Antoinette F. Konikow, M. D. Buchholz Publishing Co. New York.

OPERATIVE OBSTETRICS ON THE MANNIKIN. By Charles B. Reed, associate professor of obstetrics, Northwestern University Medical School, Chicago, etc., etc. With 254 illustrations. Philadelphia, P. Blakiston's Son & Co.

LES DIAGNOSTICS ANATOMO-CLINIQUES DE P. LECÈNE. Généralités par P. Pavie. Lésions du Sein, par P. Moulanguet. Masson et Cie, editeurs. Paris, 1930.

Item

American Board of Obstetrics and Gynecology

The following names have been added to the list of Certificate holders published in the April issue:

BACON, C. S.	BROOKLYN, N. Y.
CULBERTSON, CARY	CHICAGO, ILL.
KANE, H. F.	WASHINGTON, D. C.
SMITH, W. S.	BROOKLYN, N. Y.

A written examination for Group III applicants, for certification by the American Board of Obstetrics and Gynecology, was held on March 14, 1931, in nineteen different cities in the United States and Canada. The examination paper included the following questions:

1. Describe briefly the anatomy of the pelvic floor.
2. (a) Describe the cyclical changes occurring in the endometrium.
   (b) At what stage in the menstrual cycle should the transuterine insufflation test be done? Why?
3. Describe the autopsy findings in a case of (a) post-partum mixed infection; (b) post-partum pure streptococcus infection.
4. Give a brief outline of prenatal care.
5. Discuss the differential diagnosis of ectopic pregnancy.
6. Discuss the management of labor in the right occipito-posterior position.
7. (a) What is the most common type of (1) cancer of the cervix; (2) cancer of the corpus uteri? Describe each one.
   (b) Which is the more malignant? Why?
8. Discuss radiotherapy versus hysterectomy for (a) cancer of the cervix; (b) cancer of the corpus uteri.
9. Outline the treatment of acute gonorrhea and its complications in the adult female.
10. Describe the technic of an operation for complete prolapse of the uterus.

The practical and oral examinations for all Group III and Group II candidates will be held at the Philadelphia General Hospital, Philadelphia, Pa., on Saturday, June 6, 1931.

PAUL TITUS, M.D., Secretary,
1015 Highland Building,
Pittsburgh, Pa.

THE WHITE HOUSE CONFERENCE ON CHILD HEALTH AND PROTECTION

FOREWORD

THE editors and publishers of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY have the honor to present to their readers in this issue the reports of various committees and individuals which deal with the obstetric topics presented for consideration and discussion at the White House Conference recently held in Washington, D. C. Eventually the entire proceedings of this meeting will be published in book form. Many volumes will be required to present adequately the extended transactions but when completed this will be of incalculable benefit as a work of reference, for many and varied fields of activity and research will be covered. Because of lack of space we are able here to present merely the outstanding reports of the Committee Chairman and certain subsidiary contributions which are of particular interest to the teacher and practitioner of obstetrics. To the authors of these we desire to extend our appreciation and thanks for their help and cooperation.

The first White House Conference was called by President Roosevelt in 1909 and concerned itself chiefly with the problems of the dependent child. Due to the stimulus of this meeting the Children's Bureau of the Department of Labor was organized in 1912. The second conference was called in 1919 by President Wilson, met at Washington, and was followed by eight important regional conferences. The discussions of the social and economic status of the child were supplemented by consideration of its health and that of its mother. Quite naturally obstetrics as such acquired an important place in these deliberations and in the third and most recent White House Conference which was called by President Hoover to meet in Washington in 1930, "medical service" occupied the attention of one of the constituent and principal sections to which the activities of the conference were devoted. Months of preliminary study, research and assembling of facts by many experts in their respective fields were presented by over 15 main committees at the last conference, which was held in November in Washington.

It was felt, however, by those in charge of the meeting that more time was needed to complete the work of the Section on Medical Service. For the realization came at the very beginning of the movement that the health of the mother and her ability to bear and care for her children was a basic fact and that it was essential to determine among other things what was necessary to provide a background for safe and successful motherhood.

Dr. Samuel McC. Hamill has acted as the Chairman of the Committee on Medical Service and is to be commended for the noteworthy manner in which he developed and coordinated the labors and the varied researches so capably done by his associates. The individual committees were presided over by men and women each prominent in their particular spheres and a careful reading of their reports will afford a demonstration of how thoroughly the work has been done. The field covered in obstetrics has been a particularly broad one, as is evidenced by the catholic character of the subjects which have been investigated. Final conclusions may not be possible, but it is evident that the present survey of conditions in the United States shows the need for a more satisfactory program of obstetric care which shall entail a movement for the improved education of physicians in obstetrics as well as that of the laity and of all associated agencies interested in this branch of medicine.

Were the mere compilation of statistics and the publication of extended reports the only outcome of this conference, much would have been gained, but such publication could have only a limited value. The results of these extended studies must be put into practice and a follow-up committee for the section on Medical Service of the Conference has been authorized and it is hoped will soon begin its activities. The functions of this committee as stated by the General Chairman of the Conference, the Hon. Ray Lyman Wilbur, may be expressed as follows: To get over to the country at large as quickly as possible the importance of applying the knowledge we already possess and for which the machinery exists; to consider all the implications and the reports; to determine definitely whether further studies are required and to stimulate them; to determine the avenues through which the recommendations made by the section can be most effectively put over and to determine the soundness of the methods employed in applying the knowledge we have.

In the development of this important campaign the cooperation of all interested agencies and individuals is essential and a careful coordination of their work must be developed to avoid duplication of effort and the wasteful expenditure of funds, both public and private. The JOURNAL is prepared to assist in these endeavors to the fullest extent and stands ready to cooperate with those who are pledging their time and effort to the accomplishment of the worthy objects of the White House Conference.

THE ADDRESS OF THE CHAIRMAN OF THE COMMITTEE ON
PRENATAL AND MATERNAL CARE

By FRED L. ADAIR, M.D., CHICAGO, ILL.

THE mother is the life of the family in so far as child health and protection are concerned. We all realize that there is a wastage of maternal lives due to controllable causes operating in connection with childbearing and that our country lags behind the civilized world in the prevention of these deaths. While there may be sources of error in the interpretation of comparative statistics, and the situation in other countries may not be as ideal as it seems, nevertheless those who have opportunity of knowing the situation here, realize that the mortality of both mothers and young infants is unnecessarily high. The loss of the mother in childbirth is a disaster, not only to the newly born infant should it survive, but also to the other children in the family, if there be such. Not only are our maternal, fetal, and neonatal death rates too high, but what is most discouraging there has been little, if any, decrease in the last decade. This becomes of added importance to communities and states in view of acknowledged decline in the birth rate, which means that our human assets are becoming relatively more important. The falling birth rate is affecting particularly the families of our leaders, which is unfortunate and demands the preservation of these infant lives to as great an extent as possible.

Morbidity of the mother and offspring is a very important factor, and we need more information concerning it. Improvement is needed in our certificates for reporting births, stillbirths, infant and maternal deaths. They should be made to satisfy medical, legal, social and statistical requirements. Among the thirteen statements, on the back of the usual birth certificate, which enumerate the advantages of returning these reports, there is no mention of their medical significance, yet physicians sign the bulk of them and the information included in the report is of medical importance. Until the new birth registration blank appeared, which is not yet in general use, the period of gestation was not included in the report, ignoring the fact that many births were reported as living births where the infant was so premature that it had no chance of survival.

In most of the states it is customary to report an infant born dead as a birth on the usual blank and then file an ordinary death certificate, which is so obviously unsuited for reporting such a birth and death as to require no discussion. A single special blank, such as is in use in a few states, for reporting stillbirths is much less cumbersome and can be so drafted as to give the necessary data.

We need much more information relative to maternal deaths than appears on the usual death certificate. In addition to the cause of death we should know the period of gestation, operative procedure if any, place of confinement, and name of the person who attended the mother at childbirth. Among other things this would make it possible to compute accurate maternal and fetal mortality rates according to hospital and home delivery. Many maternity patients dying in hospitals were not delivered there. Some dying at home were delivered in the hospitals. Many deaths after abortion occur in hospitals though usually the abortion itself took place prior to admission. This increases the hospital maternal death rate materially.

Better classification of both maternal, fetal, and early infant deaths, would lead to a better understanding of their causes and ultimately to the working out of more effective means of prevention.

At present we have annually in the Birth Registration Area, approximately 15,000 maternal deaths, 80,000 deaths of infants under one month and 85,600 stillbirths. Three-fourths of the maternal deaths are due to controllable causes—infection, toxemia, and hemorrhage. The fetal and early infant deaths are due to congenital and hereditary conditions, prematurity, birth injuries, and infections, many of which conditions can be controlled. The disabilities resulting to mothers and infants are an unknown quantity, but the beds in hospitals are occupied by many women who require operations for conditions dating from childbirth. The blind, defective and otherwise handicapped children, which number 8,571,000 according to President Hoover, are, in many cases, thus afflicted because of conditions which are inherited, congenital, acquired at birth or immediately subsequent to it. Much of this could be prevented. President Hoover in his address on November 19 at the Conference on Child Health and Protection stressed the fact that there are in this country 14,000 children who are totally and 50,000 who are partially blind. Many of these can trace this condition to syphilis and gonorrhea, which can be practically eliminated as causes of blindness in infants and children by adequate prenatal and postnatal care. There are 300,000 crippled children, many of whom can date their disability to birth. Some of these conditions are congenital and could not be avoided. In others the deformity has resulted from birth injuries which have affected the central or peripheral nervous systems, the muscles, bones or joints. It would not be possible to avoid all of these casualties, but the better the obstetric care the fewer there will be. Appropriate postnatal care would bring many of these conditions to light so that prompt measures could be instituted for their correction. There are 382,000 children with tuberculosis, most of whom have doubtless acquired it within the family circle and many of them from their mothers. The detection of an open tuberculosis in mothers during

the antepartum and postpartum periods would not only safeguard them but also go far in protecting infants from the dangers of acquiring tuberculosis. The loss of the mother has undoubtedly been a contributing factor in the production of the 200,000 delinquent and 500,000 dependent children, and inadequate maternal care comes in for its share of blame as a cause for the 450,000 mentally retarded children and of the 675,000 presenting behavior problems. Nothing was said by President Hoover regarding the number of children afflicted with syphilis, but Stokes, from a wide variety of sources, estimates that the incidence of syphilis in the child population ranges from 3 to 5 per cent.

Many hereditary and congenital factors, as well as birth causes and postnatal conditions, enter into the production of the groups mentioned above. Many of these conditions are caused directly or indirectly by complications arising and affecting mothers during pregnancy and parturition. It is impossible to ascertain how many of the problems presented by these large groups of children could have been prevented by the proper application of the principles of prenatal, intranatal, and postnatal care, but certainly many of them could have been avoided.

The provision of proper nutrition of the infant begins immediately after birth and presupposes a mother who has been properly prepared during pregnancy for nursing her baby and also makes provision for proper postnatal nourishment in case the natural supply is inadequate. Many of these children doubtless suffered from the handicap of prematurity and lack of the special care required for such infants. Many may have suffered from lack of the proper maternal care which may have arisen from a variety of causes.

The means of prevention and control of maternal, fetal and early infant mortality and morbidity are first, the education of the public to expect and demand good and consecutive preconceptional, prenatal, intranatal and postnatal care for mothers and infants. It is useless to create the desire unless there is adequate and efficient personnel to supply the demand. This means the proper education and training of a sufficient number of physicians, dentists, nurses, midwives, social workers and others and that they be properly distributed. It further requires the proper set-up in the form of hospitals, dispensaries, etc., for giving institutional and supplying home care in urban and rural communities to all racial, social and economic groups.

Before undertaking to discuss the above requirements, it may be well to consider somewhat more in detail the importance of maternal mortality. Certain maternal as well as other deaths are inevitable, but this should not in any way retard us in our progress for the elimination of those which are preventable.

Maternal and fetal deaths often go hand in hand. Abortion is undoubtedly the most frequent cause of fetal death, but the extent to which it contributes to maternal deaths is not commonly appreciated. Practically all fetuses born prior to seven months' gestation do not survive, so that any such ending may be regarded as a premature termination of pregnancy. Such endings are too frequently fatal to the mother. This is shown by some recent statistics from the Federal Children's Bureau covering 7,346 maternal deaths in which the period of gestation is known: 2,381, or practically one-third of the deaths, followed an interruption of pregnancy prior to the seventh month. Of these, 59 per cent died from sepsis, while of 4,965 patients dying after a pregnancy of seven months or over, 30.8 per cent died from infection and 31.2 per cent from toxemia.

Sepsis was the cause of death in 40 per cent of all cases included in the study. Twenty-five per cent of the deaths from all causes had been preceded by abortion. Of the deaths following abortion, 73 per cent were due to sepsis. Of the deaths following intentional abortion, 90 per cent were due to sepsis and of those following unintentional abortion, 60 per cent were due to sepsis. These figures clearly show that preventive measures are not as effectively used in preventing deaths from sepsis following abortion as they are following later deliveries.

In the future, according to the new International Code for Classification of Deaths, all maternal deaths from septicemia will be classified so as to show those preceded by abortion. Abortions are not reportable except in New York City and Maryland, where the registration of all products of conception is required.

The frequency of abortions and premature labors is much less among those women who seek and receive prenatal care. This is probably due, in part at least, to the desire of those, who seek prenatal care, to have children while those who have no such wish, avoid such attention. It is also probable that the more intelligent and better socially minded women receive such care whereas the more ignorant and irresponsible groups carelessly avoid attention until nature forces them into the hands of the most accessible attendant.

In the Children's Bureau's study the maternal death rates from abortion are higher among the negroes than the whites, and in urban than in rural districts, and in hospitals than in homes. Eighty-nine per cent of the women whose deaths followed abortions were married. Of the 1,587 abortions, for which information was secured as to type, it was found that 50 per cent were induced, 37 per cent were spontaneous, and 13 per cent were therapeutic.

It is impossible to estimate accurately the number of abortions occurring in this country. Certain calculations made in Germany indicate that there were about 240,000 abortions in that country in 1911,

a proportion of about one in every eight confinements, whereas in 1927 it is estimated that there was one to every single completed pregnancy.

In Russia, with legalized abortion, there has been an increase in legal abortions, which is attributed in part at least to the decrease in secret abortions. Similar conditions apparently exist in other countries.

One might ask whether or not there is developing a disregard for human life in its beginnings and if much of the mass propaganda of a commercial and other character which is permeating modern civilization does not have a far-reaching psychologic effect upon our ideals of life. One must confess that the open display of literature and devices in drug stores is a blow to one's ideals.

The so-called therapeutic abortion which is charged with about 13 per cent of the fatalities from abortion in the Children's Bureau's study is a makeshift and a confession of our medical ignorance, for we should ultimately have sufficient knowledge to save life without destroying it. The alleged social and economic reasons should be possible of other solutions by sociologists and economists working in conjunction with medical scientists.

Abortion, whether intentional or unintentional, is a very serious medical problem, and the increase in the number is doubtless an important factor in the failure to reduce our maternal death rate. Properly collected statistics should in the future clear up this point.

The subcommittee on the education of midwives has pointed out that the maternal death rate in this country where doctors attend most of the confinements, is higher than it is in Europe where well-trained midwives furnish the greater percentage of care. Their midwives are well trained while ours are not. Yet statistics in this country indicate that in general the mortality statistics from the cases attended by doctors are not better than those cared for by our untrained midwives. What is the answer? The doctors care for more abortions and more complicated cases, they use more anesthesia, they deliver more cases artificially, they come in contact with more infectious material and they give, as a rule, no nursing care. In defense, it might be added that the midwife has had, at best in this country, little or no opportunity for education and training. It should be stated that the doctor of a generation and more ago had more or less thorough theoretical training in obstetrics, but in his undergraduate days he was fortunate if facilities were available for him to see many normal and abnormal cases delivered, and that if he had supervised instruction while performing a delivery, he was an exception and not the rule. Midwife practice has never become an established institution in this country, and doctors have taken the responsibility for attending women in childbirth from the earliest pioneer days. When

they were not available some neighbor or friend more or less familiar with labor assumed the responsibility. There are only two schools for midwives in this country and they are recent. Until of late the supervision of midwives has been very lax and even now it is adequate in very few localities. The greatest need for midwives is in sparsely settled districts and among the negro population, especially of the South. This means that the midwife question is a local problem. There is apparent need for them in some sections and provision should be made to educate and train them in established institutions. It is imperative that subsequent to their education they work in the communities and among the people who need their services, otherwise there is no use educating and training them. The midwife should not be recognized as the person to fit into the ideal and ultimate scheme, but only as a stop-gap until the better plan of nurse and doctor, both working in their respective fields, can be evolved and established. It is essential that the midwife be trained and educated in her field of activity, that she be properly licensed and that she carry out her work under medical supervision and control.

The studies made by the subcommittee on obstetric education of nurses show that the education of nurses in the field of obstetrics has not been adequate. Their education in this branch should have as its objective their preparation for the complete maternal care of patients in the home and in hospitals. Certain numbers should receive special advantages to prepare them to go into the maternity and infancy branches of public health work. Others should receive the necessary education and experience to fit them for supervisors and teachers of obstetrics in hospitals and dispensaries. It is probable that there may be a definite field for a limited number of nurses, especially the colored, to receive thorough midwifery training so that they could act as direct supervisors of midwives under medical direction. There has been some discussion of training nurses to practice midwifery and replace our untrained midwives. This would perhaps provide some alleviation of the situation if they practiced where they were needed. It is very doubtful if it would be the best permanent solution.

We have, in this country, the nucleus of a plan which could be worked out and should be superior to any other in the world. There is a large body of nurses somewhat lacking in obstetric training, but who have had good fundamental training in nursing. There is a large group of physicians whose facilities for clinical training in obstetrics have been too meager. The plan of having doctors and nurses working in conjunction has been successfully tried with excellent results in a number of localities, in various institutions, and to some extent in the private practice of physicians. It is a conviction that the general extention of such a plan through the country would be superior to any other scheme which could be inaugurated.

In connection with obstetric nursing and to fill a need in the nursing of mothers and infants there should be a place for a group of well-trained personnel who could supply good nursing care to mothers and infants at a cost lower than that requisite for the more highly trained registered nurse. This need might be met by a system of hourly nursing such as is in vogue in many of the larger communities or by trained nursing attendants. On the other hand, this does not seem to entirely fill the gap. Some consideration has been given at various times to the latter, but no great progress has been made in reaching a solution. It might be debatable whether or not it was desirable to add to the already rather abundant nursing personnel less highly trained individuals. The question of an oversupply of nurses might be similar to the one with regard to physicians, namely, the problem of proper distribution. Some communities have a lack of sufficient nurses and medical personnel or seem to feel they are not well supplied whereas there is a superabundance in other sections.

Many people are unable to pay the nursing and medical fees required by intensively trained personnel. These services must be rendered by those of lesser but adequate training, who do not demand the high fees expected for more expert service. The trained nursing attendant and the medical practitioner with good training in obstetrics should go far in meeting the needs of the lower income groups.

The distribution of well-trained physicians to serve the various needs of the country without depletion in one section and congestion in another, is a problem apart from the education of a sufficient number, which is apparently being accomplished. The problem of proper distribution comes after the selection and education and graduation of the medical students though some attempts are being made by means of scholarship, etc., to place men where they will be needed after they have qualified to practice. It is possible that the future selection of men for the medical profession may be made on more careful scrutiny of their moral and intellectual qualifications with attention to their adaptability to the geographic, social and economic needs of various districts and to types of medical practice.

Appropriate, but sometimes ineffectual, attempts are made to select medical students from the standpoints of ability and character.

It is undisputed that there should be sufficient preliminary training of those with native ability in cultural, humanitarian and scientific knowledge prior to entrance into the medical college. Here instruction should be given in the preclinical basic sciences and be correlated with the subsequent clinical teaching. There should be a closer inter-relationship between the preclinical sciences and the clinical branches of medicine by a keener interest of those teaching the basic sciences, in clinical facts, and of those teaching the clinical branches, in the fundamental sciences.

The curriculum should not be so sharply set off between the first and second biennium. It is probable that more dovetailing would be advantageous to both student and teachers.

The student should also be impressed with the idea that these basic sciences are requisite foundations to be utilized in his life's work. This could be accomplished by showing the relationship to the human being, by convincing the student that he is not working for credits and simply accumulating facts to be retained only until sufficient credits are obtained. Doubtless one of the best means of impressing this idea is by means of the comprehensive examination which could be required as a preliminary step to entrance into the work of the clinical years, when definite efforts should be made to keep up the contact of the students with some one or more of the basic sciences. This applies to all undergraduate students and to those who are taking postgraduate training, but it is of particular importance to those who by serious and intensive graduate work are preparing themselves for specialized private practice and especially to the smaller group who plan to take up careers as teachers and investigators.

It has been reported that the facilities for the education of physicians in obstetrics have not been adequate. The lack has not been so much along the line of theoretical training as it has in the application and especially in the clinical advantages. There can be no good obstetric practice in any country unless the doctors are thoroughly educated as well-trained obstetricians. This is the key to the situation.

The obstetric education of physicians must satisfy several demands which are essential to the best interests of maternity and infancy. In general, medical education must fill the needs of the country as a whole. There are many sections of the country where small communities and sparsely settled districts are unable to support or give the necessary facilities with which a physician can work satisfactorily. There are other communities in which there is sufficient work with compensation to support a physician though this community may not be in a position to supply the facilities which are necessary for the best type of medical work. It is natural that physicians should not seek these types of communities. They must have adequate compensation for a livelihood which problem could be met by subsidies, but in addition to this, most well-trained physicians of the present day feel the need of adequate laboratory, x-ray, and hospital facilities for the purposes of diagnosis and management of their cases. The movement for the establishment of rural hospitals should have a very definite effect in bringing about a proper distribution of physicians who are educated and trained to carry on this type of work. These physicians in these small communities must be general practitioners. It is therefore vital that the obstetric education should provide adequate training to this type of medical practitioners in the field of maternity and infancy.

Many physicians receive no more than undergraduate training. The majority of states and the majority of schools do not require an intern year. From our survey it is apparent that most undergraduates do not receive sufficient practical training in obstetrics. Those who secure the year's training as an intern are as a rule much better equipped, but even here there is not infrequently a lack of sufficient clinical experience in obstetrics.

In somewhat larger communities it is possible for men to undertake more or less specialization. A man might specialize in surgery and obstetrics or at least devote his major attention to these branches. He should have opportunity, by means of postgraduate courses of various types, to increase and improve his obstetric knowledge so that he would be in a position to furnish assistance to more general practitioners who have had less opportunity for perfecting themselves in these lines. This demand for postgraduate training could be met by courses in the various medical schools, by provision for such courses in various special maternity hospitals, by greater attention to obstetric clinics at medical society meetings and by extension and circuit courses which are perhaps somewhat better adapted to the needs of the general practitioner.

Provision must also be made for the adequate training of specialists in obstetrics and gynecology. There are movements in various institutions providing facilities for meeting this need. In the recent past it has almost been necessary for men to seek training abroad in the various women's clinics of Europe to secure such training. This is no longer imperative, but as yet the facilities in this country are too meager to train sufficient men adequately to supply the demand. This special training should cover a period of at least three years following the completion of a rotating internship and should consist of certain fundamental training in the basic sciences pertaining to maternity and early infancy, with abundant opportunity for clinical training in obstetrics, diseases of the newly born, and gynecology. Many European countries set up separate standards for general practice and for various specialists.

Efforts are being made in this country to require certain standards before a physician is recognized as a specialist in certain fields. The American College of Surgeons has set up certain standards with the idea of accomplishing certain ideals and of recognizing the best available men in the various communities. Other organizations and boards have set up various standards. Recently there has been formed the American Board of Obstetrics and Gynecology, which has begun to issue certificates to men whom they consider qualified for recognition as specialists in this line. This represents a progressive movement which deserves the encouragement and support of the medical profession.

It is necessary in a comprehensive educational program, as it pertains to obstetrics, to provide opportunity and facilities for the education and training of men, not only to become specialists, but also to become educators and investigators in the domain of maternity and infancy. This requires certain innate qualities and also a prolonged experience, preferably in association with outstanding men in these fields. It is difficult to place a time limit on such activities, but it is suggested that a minimum time period would extend from five to ten years. Education is, of course, a continuous and progressive matter, and one cannot arbitrarily divide it into time periods, but an outline as the above indicates in a general way the educational needs as they pertain to this branch of medicine.

It is vitally essential for the welfare of the community, particularly of mothers and infants, that we have qualified men in the various fields of activity which have been enumerated.

Various states have undertaken the responsibility of giving undergraduate medical instruction as is shown by the fact that there are 30 state medical schools of which 8 have only the instruction usually given in the first biennium. One could assume this is done on the theory that the state should fill the need of its citizens for medical practitioners. Some states have gone further and are now furnishing postgraduate instruction, not only to give special advantages to the practitioners of the state, but also to train specialists in various fields.

Inasmuch as maternity and infancy have become a state and even a national problem would it not be well to strike at the source and see that the personnel and the facilities for education in the branches of obstetrics and pediatrics are adequate, in these state institutions? This does not mean that such facilities should not be adequate in other types of medical schools, but it does mean that the states should definitely assume such responsibility for their own institutions. The various Acts and proposals of Congress indicate clearly that the problem of the proper care of mothers and infants is a matter of national concern.

Inasmuch as the education of physicians in obstetrics and pediatrics is absolutely fundamental and because the national government has already and in various ways supported educational institutions for military, agricultural and other purposes, it should be seriously considered whether or not it would be wise for the federal government to assist in building up adequate facilities for strong departments of obstetrics and gynecology and pediatrics in the state medical schools particularly.

There are other educational features which can be only rather briefly mentioned here. The social workers are very valuable adjuncts in carrying out proper maternity and infancy work. The

problem of illegitimacy alone opens up a wide range of activity which has been inadequately handled from the standpoint of both mother and infant.

Very little attention has been given to proper education and training of social workers in maternity and infancy work. An educational program for them in this field has been outlined in the report on the education of the laity. It is also important to see that obstetricians and other medical practitioners secure some idea of the importance of social service to their work and their patients. There should be some educational correlation so that the social service workers receive the medical viewpoint essential for their activities and that the medical students also obtain definite ideas relative to the social phases of medical work, particularly as it applies to maternity and infancy.

The social workers form an important bridge between the medical profession and the laity and should be very helpful in assisting to carry out educational programs among the laity.

Probably the most effective way of educating the laity is by personal contact with well-informed personnel. Numerous methods have been and are being used. The essentials are that the subject matter be accurate, understandable and interesting; that the methods of dissemination be appropriate and that those to whom the information is directed be reached.

Not infrequently inaccurate and misleading information is circulated. This is often based on fads or information which has not been definitely proved and is often productive of harm in that it leads patients to seek and even demand certain obstetric procedures which are not established and practiced by those who are best qualified to know. Publishers, reporters, and authors should have an opportunity to check the accuracy of articles which are submitted for publication. These articles may be good news, but not beneficial to the public. In the past it has not infrequently happened that certain procedures have been well advertised and achieved considerable popularity only to be discarded at a later date because they were harmful or not valuable.

Notable service has been done by numerous local organizations as well as those of state and national scope in educating the public in the fields of maternity and infancy. Some of these are governmental such as the Children's Bureau, the U. S. Public Health Service and the Bureau of Education, all of which have done good work.

The American Child Health Association, though primarily interested in Child Health, has materially furthered the cause of maternal care. Various local organizations, too numerous to mention individually, have by their example, propaganda and scattering of their personnel, extended their influence over wide areas. There are many national organizations, whose prime objects are not in the fields of

maternity and infancy, but which have indirectly exerted a tremendous influence for good by improving institutions, personnel and conditions surrounding mothers and infants.

It is noteworthy that none of these national organizations cover the field of maternity as their prime object. The Joint Committee on Maternal Welfare comes nearest to this objective, but its activities have been very limited for economic reasons and because its purposes have been mainly to interest the medical profession in better obstetrics. It might be well for this committee, as a nucleus, to enlarge its activities to form an organization which has as its primary object the consideration of the numerous problems surrounding maternity. It is apparent from the study of interested organizations that there is a lack of coordination, and while excellent work has been done, no one has made the development of maternal care its exclusive concern. There should be some nongovernmental organization to bring together and harmonize the activities of the many groups which have a greater or lesser interest in maternity.

It should be recognized that each person has to assume responsibility for his own conduct and welfare and that each community must solve its own problems, but many times outside stimulation with sane advice and material help is of enormous value.

There should be serious study of the plans of rendering service to mothers and infants in various types of communities under varying conditions. Much of value could be learned from the plans which have already been successfully operated in some localities. Some are moving along smoothly and with the expenditure of little effort to attract outside attention. Some of these plans may be more successful than others which are better known.

Each community knows some of its needs and usually some efforts are being made to meet them. They are not always well directed and are often inadequate, but these efforts nearly always have real merit and should be utilized in perfecting the organization of the work in that community. It should be possible to pull various agencies together so that they could fulfill their part of the general pattern. Infant Welfare Societies, Visiting Nurses' Associations, hospitals, dispensaries, settlements, medical schools, local nurses' organizations, medical societies and others, who are interested in maternity and infancy can be brought together to work out an adequate plan for furnishing appropriate care to mothers and infants during the prenatal, intranatal, and postnatal periods.

Smaller centers of population and rural communities present special problems which will have to be met in various ways. Doctors, nurses, and in some localities midwives, are necessary. Local and county hospitals and dispensaries would seem to be essential. The hospital facilities in some areas are entirely inadequate, even if avail-

able at all. Those available for negroes are more inadequate than those for the white population. In one city, which is probably better supplied with maternity beds for negroes than many others, it is necessary to send mothers home with their babies a few days after delivery, in order to make room for the new mothers arriving in labor. Practically no hospitals are available for them in rural communities. This lack of proper hospitalization for negro mothers may be a factor in their high mortality rate which is about twice that for the whites, though even with the same care in institutions having parallel services for white and colored mothers the mortality rate seems to be higher for the latter.

In all communities there should be the necessary institutions, material and personnel, be it doctors, nurses or midwives, for furnishing adequate and consecutive prenatal, intranatal and postnatal care. The studies made by the committee show that at the present time this is not available, and even in communities where it can be had, it is not universally supplied due to some defect in the educational plan, the scheme of organization, or to some lack of care or interest on the part of the potential mother or other individuals involved.

In addition to the routine care the committee's reports point out that there must be provision for special attention to nutrition, oral conditions, venereal disease, tuberculosis, heart disease, focal infections, and other medical and surgical complications. There should be some selection of cases which may need hospitalization. It is important to avoid emergencies in so far as possible and many of these can be foreseen or diagnosed early. In the study made by the Children's Bureau there were 1,893 cases past seven months' gestation who died in a hospital; 996 of these, or more than half, were emergency cases.

In small communities it is obvious that this care cannot be carried out by specialists, but the general practitioner, who is the backbone of the medical profession, can see that it is very well done if the proper organization and facilities are at hand.

For a long time the doctor has looked at medical problems from the standpoint of the individual patient; it is his duty to view these affairs from the standpoint of the community also. It is necessary that doctors, individually and collectively, through their medical societies, participate and assume leadership in matters pertaining to the health of mothers and infants, and provide consultation and other service where needed.

There are many social and economic problems surrounding mothers and infants which go hand in hand with medical problems. The social workers can be of enormous assistance in securing satisfactory and helpful service to these mothers and infants, who require special attention, from various agencies for either social, economic, or medical reasons.

There are many gaps in our knowledge regarding the factors and causes of morbidity and mortality of the mother, the fetus, and the newly born infant. It is essential to fill these gaps, but we should first strive to see that every mother and infant receives the benefit of the knowledge we already possess. If this is done it will be easy to apply new knowledge as it is acquired.

We know that such factors as race, environment, social and economic conditions, medical care, physical and mental status, period of pregnancy, complications, methods and grade of care and character of attendant and place of confinement all have much to do with the results.

In the maternal mortality study of the Federal Children's Bureau a report on prenatal care was secured for 5,636 of the cases. Of these, 53 per cent received no prenatal care, and in 72 per cent it was inadequate.

The character of the onset of labor was stated in 6,878 cases for which the period of gestation was reported. It was spontaneous in 4,411 cases; artificial in 1,686 cases; and in 781 cases there was no labor. Why should 25 per cent of these cases have an induction of labor, and 10 per cent be fatal with labor not having even started?

The termination of labor was reported in 6,657 cases in which the period of gestation is given. It was spontaneous in 3,428, artificial in 2,255 cases, and in 974 instances labor was not terminated. Why should there be 30 per cent of the fatalities with artificial termination, and about 12 per cent be undelivered?

Nearly one-third of the deaths followed an interruption of pregnancy prior to the seventh month, and in this group almost 60 per cent died from sepsis.

There must have been something wrong with the attention given to these mothers, especially when in the whole group of 7,380 deaths 40 per cent died from infection, 26 per cent from toxemia, and 11 per cent from hemorrhage. This makes a total of 77 per cent fatalities from causes which are controllable.

We do not have all the results for the fetuses and infants, but we do know that only 42 per cent of these pregnancies ended in live births. It is safe to say that the neonatal mortality and the morbidity rates in the others were very high. We do not know what sort of postnatal care the babies, who survived their mothers, received. Postnatal care, which in occasional cases may help to reduce maternal mortality, is more important from the standpoint of morbidity.

We have little statistical information relative to the morbidity of mothers, but probably half of the gynecologic operations are necessary as the result of poor care during pregnancy and childbearing.

The causes of maternal morbidity incidental to childbearing are

birth injury, infection, and toxemia. Much has been and can be done to alleviate these conditions, and it is only fair to state that, while mortality is taken as the standard for the comparison of results, morbidity though less tangible should also be considered.

We have mentioned the effect of various procedures and events upon the mother, and now it is important to state the causes of fetal and early infant mortality and morbidity. In 1929 approximately 31 per cent of the infant mortality in the birth registration area was due to prematurity, congenital debility, and syphilis; 8 per cent was due to congenital malformations; 8 per cent to injury at birth; and 8 per cent to other diseases of early infancy and to unknown or ill-defined causes. The causes which are more or less amenable to management during the prenatal period are prematurity, maternal toxemias, infections and syphilis, all of which can be controlled in a measure to the benefit of the fetus.

Malformations might perhaps be controlled by preconceptional care, but as yet we do not know how to accomplish this.

During the intranatal period much can be done by adequate care to limit the number of deaths caused by suffocation, aspiration, and injury to the central nervous system, as well as other types of birth injury which do not lead so frequently to fatalities as to morbidity. Injuries to the brain and cord are often responsible for the failure to establish respiration. Infants with birth injuries may be born dead, die soon after birth, live a longer or shorter period with varying amount of disability, or apparently recover. These injuries are of the utmost importance in causing both mortality and morbidity, and cannot always be avoided. They occur especially in premature infants. They follow after spontaneous labors of a short, violent type, prolonged, hard labors, instrumental deliveries, breech extractions, versions, and even after cesarean sections.

The postnatal causes of fetal death are thermic, due to isolation or refrigeration, which are particularly dangerous to the premature infants; to chemic causes, to infections or to disturbances of nutrition. Proper postnatal care should begin immediately with birth and be followed through consistently.

Prematurity can be greatly reduced by proper prenatal care. Syphilis in the fetus could be eliminated by adequate preconceptional care. Toxemias can be controlled with the saving of some infant lives. Infections causing fetal death and disease can be lessened. Deaths from suffocation and aspiration can certainly be reduced, and the mortality and morbidity from birth injuries can surely be diminished. Practically all of the postnatal causes of death could be controlled, if not eliminated. We all admit that our present knowledge is inadequate in many respects, but we make an urgent plea for the universal application of that which we do possess.

We would like to know more about the problem of abortions and the factors producing or leading up to them whether intentional or unintentional. The morbidity and mortality resulting from this is very great. There is much to learn about premature births and their causes. There are many deaths in fetuses and the newly born which are difficult to explain on clinical or pathologic grounds. There is much to learn concerning the effect of various maternal states and diseases upon the fetus.

We know much about infection which takes its toll of mothers and infants, but there are still some unexplained facts, relative to susceptibility and immunity, which are of considerable importance.

Of the causation of toxemias we are in virtual ignorance though much data have been accumulated.

So much that is lacking in fundamental knowledge is pointed out in the detailed reports of the committee that time and the scope of this address will not permit of detailed enumeration. In anatomy, which is relatively old and more or less stable, there is still much to be added to our information pertaining to the fetus and mother. The pathology of the embryo, fetus, and newly born is still a fertile field for investigation, and the mother presents many unsolved pathologic problems especially in regard to the toxemias. Bacteriology, and especially immunology, could contribute much if a way of preventing maternal, fetal and infant infections could be shown. Physiology with chemistry of various categories is now an actively fertile field in the study of sex and growth hormones. Nutrition of both the pregnant mother and the fetus, and of the lactating mother and infant, are problems which will require a vast amount of work for solution.

Eugenics hardly comes within the scope of this conference and yet many infants are born who are useless or worse in our social scheme, so we would like to know more about hereditary influences and be able to prevent the birth of those who are defective and constitute a burden or menace to society. If we could be certain of our laws of heredity as applied to human beings, the prevention of the birth of these individuals by stopping the procreative powers of their parents would be a blessing to humanity. It is difficult to know just how far to go with such a program, but we should progress slowly but surely.

In conclusion, it may be stated that the present situation with regard to maternity and infancy is not satisfactory.

To remedy this situation our present knowledge must be generally applied so as to provide appropriate preconceptional care to insure the proper growth and development of normal parents who reach the reproductive period healthy and free from venereal and other transmissible diseases and from other conditions which may make childbearing dangerous to them or the fetus or a hazard to society. These

parents must be imbued with the desire to have normal, healthy children in sufficient numbers to perpetuate the best there is in our human race.

Prenatal care of adequate degree must be followed by competent intranatal and postnatal care for the health and protection of both mother and infant. In order to accomplish these, it is necessary to have properly trained and educated doctors, nurses, midwives, dentists, social workers, mothers, and laity, who come in contact with the problems of maternity and infancy.

In addition it is necessary that proper organizations be set up in various communities, that the necessary institutions be established and the essential personnel be supplied. Luxuries are not lacking in this country; surely it is not a luxury to prevent morbidity and mortality among mothers and infants. Perhaps we are becoming too ease-loving and self-satisfied and may be losing some of our sense of proportion and ideas of fundamental values.

The doctors individually and collectively should lead in these movements to secure the health and protection of both mothers and infants. We should apply and disseminate our present knowledge, and our basic and other medical scientists should continue, as they will, to push forward so that new knowledge may be secured which will add to the security, improvement, health, and happiness of future generations.

THE UNDERGRADUATE TEACHING OF OBSTETRICS*

By Palmer Findley, M.D., Omaha, Nebr.

TO APPRECIATE the importance of undergraduate teaching of obstetrics as a determining factor in maternal and infant mortality, we do well to inquire into the conditions which prevail in countries which have a lower mortality rate than do we in the United States of America.

The indictment has been made by many of our American contemporaries that the United States ranks highest among the civilized nations of the world in maternal mortality. Their statements have been challenged on the ground that the maternal mortality statistics of the United States and foreign countries are not comparable. A special subcommittee of the Committee on Prenatal and Maternal Care is studying the comparability of these statistics but its report is not yet available. In the absence of later data the committee wishes to call attention to a discussion of the Statistical Comparability of Maternal Mortality Rates in the United States and Certain Foreign Countries in a report on Maternal Mortality published by the Fed-

eral Children's Bureau. From this report it appears that the reporting and classification of maternal deaths are fairly comparable in the countries from which statistics are quoted.

The comparison of the maternal mortality rates of the United States and foreign countries has been challenged also on the ground that the statistical comparisons were made in the years 1918-19, during which time the United States was experiencing a ravaging epidemic of influenza. It should be borne in mind that the influenza epidemic of 1918-19 was not confined to the United States but was fully as virulent in Europe during these years. Granting the inevitable inaccuracies of statistics the committee appealed to the Children's Bureau of the U. S. Department of Labor for data from the most dependable source. Under date of June 5, 1930, the Children's Bureau published a statistical table embracing official reports from 25 nations, beginning with 1915 and ending with 1928.* During these years the United States birth registration area expanded from 10 to 44 states. We find in this report that Sweden has fairly consistently maintained the lowest maternal death rate and that the United States has averaged highest of the 25 nations represented in this tabulation. Excluding the influenza years of 1918-19 the statement still holds good that the United States exceeds the other 24 nations in maternal mortality. Omitting the influenza years of 1918-19 and for purposes of comparison, taking the years of 1922, 1923, 1924 and 1925 (there are no available returns from Sweden since 1925), we find that the maternal mortality rate in Sweden was 25, 23, 24, and 26 respectively per 10,000 live births and in the United States, in the same period of time, 66, 67, 66, and 65, a ratio of approximately 1-2.5. Again excluding the influenza years of 1918-19 we find that the first three years represented in the statistical report of the Children's Bureau (1915-16-17), compared with the last three years (1926-27-28) show a maternal mortality of 61, 62, 66 per 10,000 live births, as compared with 66, 65, 69 per 10,000 live births. These rates would bear out the contention, often advanced, that our maternal mortality has not been lowered since 1915, but on the contrary there has been some slight increase in the expanding birth registration area.

Dr. Janet Campbell, reporting for the British Medical Society on "The Protection of Motherhood," 1927, gives England and Wales a maternal mortality rate in 1915 of 39.4 for 10,000 live births and 41.2 in 1926. In France the death rate was 60 for the years 1915-1919 (war years) and Germany (1920-24) has a mortality rate of 51. Norway and Holland share with Sweden with a maternal mortality rate of 25 and 26 respectively for the year of 1925. Dr. Campbell, in commenting on the report said: "The analysis of the causes of deaths serves to show that the majority of fatal cases should be under the

control of preventive methods and is a striking brief for the urgent need of prenatal care.''

It is a thought-provoking commentary that the maternal mortality in the United States during the years of the World War far exceeded that of France, Italy, Hungary, Czechoslovakia, Belgium or England.

Whatever other factors may be operative in producing so wide a discrepancy in the maternal mortality rate of the United States of America as compared with that of Holland and Scandinavia, it is evident that lack of the superior clinical facilities afforded by these countries accounts in no small measure for our deplorable results. In the curricula of the medical schools of Holland and Scandinavia obstetrics shares equally with internal medicine and general surgery, while in the United States, until quite recently, the proportion of teaching hours in general surgery as compared with obstetrics was 4.5 to 1; it is now approximately 2 to 1. Furthermore, the facilities for clinical teaching in Holland and Scandinavia are vastly superior to those found in most of our teaching institutions. In the University of Lund, Sweden, for example, the students devote four months to clinical obstetrics. Each student will have personally conducted an average number of 38 to 40 labors, 1 or 2 forceps cases and 1 or 2 abortions. Some will have performed versions, manual delivery of the placenta and like maneuvers. The students are closely supervised in all their work and have abundant opportunity of witnessing obstetric procedures conducted by the teaching staff. Prenatal and postpartum instruction is stressed in the clinic. Nowhere in the United States can we approach such clinical instruction.

The comments of Aleck W. Bourne, on the teaching of obstetrics and its bearing upon maternal mortality in England apply with added force to conditions existing in the United States. He writes: ''The solution of the problem lies in the medical schools, and while we can proudly point to many advances in obstetrics, we are unable to include the teaching of obstetrics as an example of these advances. The bed accommodations in general hospitals are still very inadequate for teaching purposes, and the time devoted to the teaching of this branch of medicine is too short. As a subject of instruction midwifery should rank equally with medicine and surgery.''

To ascertain, in detail, the manner in which obstetrics is being taught to medical students, questionnaires were sent to all Deans and to Obstetric Department Heads of all medical schools in the United States, to a large number of hospitals throughout the country and to a selected group of graduates of all medical schools for the purpose of ascertaining how well their undergraduate training in obstetrics prepared them for the general practice of medicine. Following is a brief summary of the replies to these questionnaires:

MEDICAL DEANS

Questionnaires were sent to the Deans of all Medical Schools which provide for four years of instruction. The response was most gratifying, all but seven schools returning more or less complete questionnaires.

In response to the inquiry, *Do you favor a unified department of obstetrics and gynecology?* there was a total of 56 replies with 42 in the affirmative and 14 in the negative. It is gratifying to the committee to note the evident approach to the conditions prevailing on the Continent where the two subjects are almost uniformly combined.

There were 55 responses to the inquiry: *In what years are obstetrics and gynecology taught?* Of this number, 38 answered Junior and Senior years; 17, Sophomore, Junior and Senior years and 2 failed to report. Then followed the inquiry: *In your opinion, in what year should this instruction begin?* There were 55 replies with 35 favoring the Junior year, 22 the Sophomore year. We are to infer from the replies of the Deans to this inquiry that approximately 60 per cent of them favor confining the instruction in obstetrics and gynecology to the Junior and Senior years.

The committee was desirous of ascertaining whether or not there exists in our medical schools a satisfactory *correlation between the teaching of obstetrics and gynecology and the basic sciences.* Accordingly Deans Charles Poynter of the College of Medicine of the University of Nebraska and J. M. H. Rowland of the College of Medicine of the University of Maryland were requested to make a report of their findings and opinions on this question. Their report is to be printed separately. These men are well qualified to pass judgment on this important problem because they have taught the basic sciences, and both have practiced a clinical specialty—one obstetrics and gynecology and the other general surgery. The Deans of 51 schools replied to the inquiry on this point in the questionnaire, 20 in the affirmative, 28 in the negative, and 3 who were only "fairly satisfied."

In a large proportion of the Continental schools a *resident maternity service* is required of the students. We desired to know to what extent this exaction is maintained in the United States and whether the Deans favor the requirements. Replies were received from 57 Deans, of which number 53 expressed themselves in favor and only 4 were unfavorable. However, in response to the inquiry as to whether it is possible to give such a service to their students, only 30 replied in the affirmative, 17 said it was impossible, and 6 were able to give a partial maternity service. In the opinion of the committee this is a problem of prime importance. Such a service would provide direct contact with patients under competent supervision, and it is contended that the opportunity to live in an obstetric atmosphere for a

given time will add greatly to the efficiency of clinical teaching. A maternity service is indispensable if we are to attain to the ideal in the teaching of obstetrics.

We asked the opinion of the Deans as to what, in their judgment, is a *reasonable number of labors for a student to observe.* There were 50 replies to this inquiry. The numbers ranged from 2 to 10 in 10 replies the lowest number being 5, from 11 to 20 in 17 replies, from 21 to 30 in 16 replies and from 40 to 50 in 7 replies. In 39 schools it was possible for the student to observe the number of deliveries which the Dean considered reasonable, in 10 it was not, and one did not report.

The Deans were next asked, *"What is a reasonable number of labors for a student to deliver?"* There were 54 replies. The numbers were as low as 2, 3, 4, 5, 5-6, 7, 8-12, 6-12 deliveries respectively in 8 replies, 6 deliveries in 8 replies, and 8 deliveries in 2 replies. Thirty Deans specified numbers ranging from 10 to 15-20, and six thought the number should be 20 or more, highest number being 30 in one reply. In 37 schools it was possible for the student to deliver the number of patients that the Dean considered reasonable, but only three of these were in schools where more than 15 cases was considered the reasonable number to deliver.

To the inquiry, *Is a hospital intern year required for the degree of M.D., and if so is a maternity service required?* there were 57 replies with only 10[1] reporting that a hospital intern year is required before granting an M.D. degree; in 7 of this number a maternity service is required. The committee is of the opinion that a universal requirement by all medical schools for a rotating hospital service for one year, embracing an adequate maternity service, would go far in solving the difficulties incurred in providing sufficient clinical material in obstetrics for the student body.

As to the *kind of instructors* favored by the Deans, 57 replied; 3 in favor of all full-time instructors, 18 for part-time instructors, and 36 for both.

Finally, to the inquiry as to whether *voluntary and unpaid instruction* in obstetrics and gynecology has been satisfactory there were replies from 51 Deans, 23 answering in the affirmative, 28 in the negative.

GRADUATES OF MEDICINE

With the thought in mind that much valuable information might be procured from recent graduates of medical schools, questionnaires were sent to six graduates of each of the schools listed as giving a four-year course. The years 1921 to 1928 inclusive were chosen. We wanted to obtain from them an expression of opinions as to the value

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[1] There are 13 medical schools in the United States that require a hospital intern year before granting an M.D. degree. In one of these the requirement becomes effective in 1933.

of their instruction in obstetrics and gynecology in meeting the demands of the general practice of medicine. There were 158 replies to our questionnaires, 6 from the class of 1921, 55 from the class of 1922, 1 from the class of 1924, 4 from the class of 1926, 84 from the class of 1927, 3 from the class of 1928, and 5 not reporting the year of graduation.

Respecting the *length of service* in a maternity, as students and as interns following graduation, we find 8 report a service of 21 to 46 days, 20 of 6 to 16 weeks, 95 of 1 to 12 months, 1 of 18 months and 1 of 48 months. There were 16 of the number who report no maternity service; 17 not replying.

Table I shows the number of deliveries conducted by these graduates during their junior or senior years, or as interns.

TABLE I. NUMBER OF GRADUATES CONDUCTING SPECIFIED NUMBER OF DELIVERIES AS

DELIVERIES	JUNIOR	SENIOR	INTERN
1– 10	33	55	12
10– 20	16	37	18
20– 30	6	17	21
30– 40	4	10	14
40– 50	–	3	5
50– 75	–	5	25
75–100	–	–	10
100–150	–	1	12
150–200	–	–	7
200–501	1	–	7
Assisted	2	–	–
None	81	18	13
No report	15	12	14

These graduates were asked if their *lectures were illustrated by charts, lantern slides, movies, and specimens*. It was revealed in the answers that charts had been seen by 122, slides by 65, movies by 23, and specimens by 115. No charts had been seen by 25, no slides by 69, no movies by 113, and no specimens by 12. It would appear from these reports that at the time referred to (1921-1928) lectures on obstetrics and gynecology were not illustrated by charts, lantern slides, movies, and specimens to the extent justified by their value. However, it is presumed that this important feature of the lecture system is receiving more and more favorable consideration.

In answer to the inquiry concerning *special laboratory instruction* in obstetrics and gynecology only 57 report special laboratory instruction in obstetrics and 62 report special laboratory instruction in gynecology.

In respect to *manikin courses* we learn that of the 158 graduates 111 were permitted to perform obstetric manipulations on the manikin, 47 were privileged to witness such procedures, while 32 did no manipulations on the manikin and 95 had no demonstrations. As to hours devoted to these operations and demonstrations we find about

one-third of the number had less than ten hours in these exercises, another third less than fifteen hours and the balance from sixteen to ninety hours. Not a creditable showing for so valuable an adjunct to obstetric teaching.

We were desirous of learning to what extent *students are permitted to deliver cases in the home*, unattended by a capable instructor and clinician. Of the 158 answering this inquiry, there were 96 who were so accompanied, most of the remainder were neither accompanied nor instructed by a competent obstetrician. In a single instance or two it is recorded that they were accompanied by a senior student or intern and a few others replied that they were accompanied sometimes, or in complicated cases. The committee can see no justification for the practice of permitting students to deliver women in their homes unaccompanied by a competent instructor.

Of the 155 replies to the inquiry: *Did you have a resident service in a maternity?* 78 replied in the affirmative and 77 in the negative. In their residency 7 observed 1 to 10 cases and 25 delivered an equal number, 21 observed 10 to 20 cases and 19 delivered a like number, 21 observed 20 to 50 cases and 8 delivered an equal number, 10 observed 50 to 100 cases and 5 delivered an equal number, 7 observed 100 to 301 cases, and 2 delivered an equal number, and 1 observed 500.

Table II shows the number of abnormal cases seen by these graduates when they were students and interns.

In respect to the *time employed in prenatal clinics as students and interns* we find that out of 149 replies only 3 report 12 to 40 hours, 34 report 1 week-4⅛ months, 40 from 1-3 months, 14 from 4-6 months, 12 from 4-12 months. About an equal time was employed in postnatal clinics. There were 15 who reported no prenatal clinic work; 49 no postnatal clinical experience and 7 did not reply.

In the opinion of the group *gynecology was well correlated with obstetrics.* This was the expressed opinion of about four-fifths of those reporting.

HEADS OF DEPARTMENTS OF OBSTETRICS AND GYNECOLOGY

Replies were received from the Heads of Departments in 40 schools. Of this number 20 have combined departments of obstetrics and gynecology and 20 have separate departments. In the latter group of 20 schools there are two in which gynecology is combined with surgery. Where the departments are combined the explanation given for the combination is, in the majority of instances, for administrative and pedagogic reasons.

Of the 20 schools in which *gynecology and obstetrics are combined* 15 regard obstetrics as the major subject, one regards gynecology as the major, 3 regard them as equal in importance, and one does not report. Again we find in the group of combined chairs that the Head

TABLE II. Number and Type of Abnormal Cases Seen as Student and as Intern*

	ABORTIONS		TOXEMIAS AND ECLAMPSIAS		CONTRACTED PELVES		PLACENTA PREVIA		ABLATIO PLACENTAE		POST-PARTUM HEMORRHAGE		BAG INDUCTIONS		FORCEPS		VERSIONS		EPISIOTOMIES		PERINEORRHAPHIES		MED. AND SURG. COMPLICATIONS	
	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN	STUDENT	INTERN
TOTAL	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158	158
1– 5	43	16	58	38	58	44	58	66	17	31	45	61	51	50	53	17	66	67	41	20	31	12	31	28
5– 10	20	19	14	22	15	29	6	17	1	2	5	17	9	20	30	17	10	19	17	16	18	12	14	18
10– 15	14	13	14	20	1	9	–	8	–	3	–	6	2	9	13	18	2	10	7	17	12	11	4	14
15– 20	1	7	4	14	1	1	–	1	–	1	2	–	1	4	5	10	2	4	6	7	4	10	1	4
20– 30	8	19	–	8	–	1	–	–	–	–	–	3	1	2	6	29	–	4	4	12	4	15	2	10
30– 50	1	13	–	4	1	2	–	–	–	–	–	–	–	2	1	11	–	2	1	10	6	13	1	1
50–100	1	12	–	3	–	–	–	–	–	–	–	–	–	–	1	6	–	–	–	3	2	15	1	1
100–150	–	6	–	1	–	2	–	–	–	–	–	–	–	1	–	3	–	–	–	4	–	8	–	–
150–200	–	2	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
200–301	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	–	1
Some	13	18	10	13	17	13	6	7	8	8	11	15	4	8	10	13	7	10	14	23	18	21	30	31
None	34	11	36	12	39	31	63	34	100	81	69	32	63	36	19	12	47	18	45	23	39	16	46	21
No report	23	22	22	23	26	26	25	25	32	32	26	24	27	26	20	21	24	23	23	22	24	23	29	29

*See page 800.

of the Department is an obstetrician in 17 of the 20 schools and that he is a practicing obstetrician in every instance. Three of the Heads report that they do not practice obstetrics but do practice gynecology. In the 20 schools having a combined department all but one Head practice gynecology (one not reporting), and with but 3 exceptions they also practice obstetrics. While it may be unreasonable to require of the Head of a combined department that he shoud be equally qualified in the two fields, a near approach to this ideal would be desirable. The two subjects are so intimately related as to be inseparable and the Head of the combined departments should have a practical as well as a theoretical knowledge of both.

We are pleased to note that in all of the combined chairs the department Head conducts classes in obstetrics; didactic in every instance and clinical in all but one instance. Gynecology, however, is not taught didactically by 6 of the Heads and clinically by one. From this we would infer that the two types of cases appear in the clinics.

The question was asked whether ideal results would obtain in a combined department if the Head of the Department were an obstetrician only or a gynecologist only. The answers to this inquiry were not convincing in that they were evidently inspired by the personal attainments of the man who happened to be the Head. If a gynecologist, the answer would be "yes," if an obstetrician the answer would be "yes," but if he were both an obstetrician and a gynecologist the answer would be "no." Again the question was asked, Is it necessary for a Head of Department to have an avid interest in both obstetrics and gynecology? Of 52 Heads answering, 7 answered "no," 4 did not report and 40 said "yes."

Should an obstetrician practice gynecology? This question was answered in the affirmative by 36, in the negative by 3, and 1 made no report. It was contended that the exactions of an obstetric practice would unfit one for operative work. The committee finds difficulty in assenting to this criticism.

Replies received from Heads of Departments in 40 schools disclose but 13 schools having *special maternity hospitals affiliated with their schools*. The number of beds in these maternity institutions ranged from 39 to 200 and about an equal number of cribs. The total number of obstetric beds in the affiliated maternity hospitals was under 100 for 7 schools and over 100 for 6 schools. The total number of deliveries in affiliated maternity hospitals was less than 500 for 3 schools, 500-2000 for 4 schools and above 2000 for 5 schools. The duration of student residence in the affiliated maternity hospitals varied from one week to one month for 9 schools reporting. The students were assigned in groups of 2, 3, 4 and 6. The number of deliveries conducted or assisted in by students in affiliated maternity hospitals was less than 20 in 9 of the 11 schools reporting on this item. In two schools

the students had opportunity for witnessing as many as 60 deliveries. Twenty-eight medical schools reported affiliations with 48 general hospitals. Several schools did not reply to this question. Only 1 of the 48 hospitals was reported as not having a segregated division for obstetric service, and 1 school failed to answer this question. Twenty-nine reported on the number of normal deliveries students saw in affiliated general hospitals. In 13 schools the number was less than 15, in 9 schools it was 15 to 30, and in 7 schools it was more than 30. The size of the student group attending a delivery was usually less than 10. Seventeen schools reported on the number of pathologic cases seen by students in general hospitals. In 8 schools they saw from 1 to 5 cases, in 5 schools from 6 to 10 cases and more than 10 in 4 schools. Twenty-eight schools replied to the question on the number of deliveries conducted by students in general hospitals. In 11 schools the number of student deliveries ranged from 1 to 10 and in 8 schools the number was over 10 (one said "6-20") ranging as high as a possible 30 in 2 schools. In 9 schools the students conducted no deliveries but in 6 of these they had an opportunity to assist at deliveries. It is in this particular that obstetric teaching in the United States suffers most in comparison with Continental institutions. Witness the University of Lund, Sweden, where the students devote four months to clinical obstetrics as residents in a maternity hospital where they deliver an average number of 40 patients, and where the students are permitted to make one or two forceps deliveries and to supervise one to two abortions. In all this they are rigorously supervised and have opportunity of observing large numbers of normal and pathologic cases. With such clinical facilities afforded medical students, and midwives to a like degree, it is small wonder that Sweden leads the world in low mortality rate.

The questionnaire study showed that *prenatal clinics* were in operation in 37 of the schools and in one the clinic is in process of organization. Of this number 12 clinics were open less than ten hours a week and 19 were open ten to twenty hours a week. In a single instance the clinic was open forty hours a week. Six schools failed to report on this item. The daily attendance was 20 or more in about one-half of the clinics. In 2 clinics the attendance ranged from 30-50 and in 1 from 40-60. Each of 9 prenatal clinics reported an average yearly attendance of more than 5000 patients and each of 11 clinics reported 2000 to 5000. The balance either had less than 2000 or did not report on this item. (The figures on attendance were interpreted to include return visits.) The number of students in attendance at the clinics daily ranged from 2 to 18, 10 schools reporting more than 6 students in attendance per day. In 14 schools the students spent twenty-five hours or more in the clinics. In the other schools reporting, the time was less than twenty-five hours. The number of

patients seen at these clinics by each student was less than 10 in 4 schools, more than 10 but less than 25 in 3 schools, between 25 and 50 in 8 schools and 50 or more in 12 schools, running over 100 in five schools. The others did not report. The number of patients examined by each student at clinics was about the same as the "number seen" in most of the schools. In 27 schools students were required to practice both external and internal pelvimetry; in one school they practiced internal pelvimetry occasionally and in 8 schools they practiced only external pelvimetry. It is encouraging to note that so large a proportion of the schools have prenatal clinics. It is evident that in most institutions this important phase of clinical teaching is not developed commensurate with its importance but it is a beginning that augurs well.

Thirty-three schools reported *postpartum clinics* in operation. Two more had them in course of organization. The average time these clinics were open was two to six hours a week. About one-third the number were open ten to fifteen hours and 1 for forty hours. The daily attendance ranged from 1 to 5 a day to 15 to 20; the highest 40 to 50. Twenty-four schools reported the yearly attendance at postnatal clinics. In 3 schools it was reported to be less than 200; in 12 schools the attendance was between 200 and 500, and in 9 schools it was more than 500, running as high as 1500 in 3 schools and 600 in one. The number of students in attendance per day in the postpartum clinics ranged from 1 to 12, the average being around 6. Their hours in attendance are in some instances elective and when required they average about 20 with a minimum of 5 and a maximum of 66. Here again we find encouragement. The ideal in obstetric practice is to follow through in the endeavor to leave a healthy mother in possession of a healthy child, hence the importance of postpartum observation and direction.

Thirty-five schools had a *home delivery service*, two had none, and three did not report. Students were reported as conducting home deliveries in groups of 2 usually, but sometimes alone or in larger groups. All schools reported some supervision of students by physicians in conducting home deliveries, but in 24 it was intermittent and in 2 it "depended on the case." In 17 schools students conduct labors to conclusion unsupervised. Ten of these qualified their answers as follows: Five stated "if they are normal"; two, if they are "normal multipara"; one, "after two supervisions." Two other schools replied "sometimes" and "not always" respectively. Thirty-one reported on the number of patients delivered in their homes by students. Four schools reported none and one said "voluntary." In 18 schools the student delivered less than 10 patients; in 8 schools he delivered 10 or more. Nineteen schools reported on the number of home deliveries *seen* by students. In 12 schools they saw less than 10, in 7 schools

10 or more. For students to conduct labors to conclusion and unsupervised is an indefensible practice in the judgment of the committee. Such conditions are not in the interest of the public and are worse than valueless to the student.

Twenty-seven schools reported that students made *local examinations*. These were usually specified to be rectal and abdominal, only two schools saying that students made vaginal examinations, and in one of these he was permitted to make only one vaginal examination. The replies to the following queries were as follows: Are you satisfied with your clinical facilities? Yes—14, No—23. Are you satisfied with your staff personnel? Yes—19, No—18. Are you satisfied with your equipment? Yes—14, No—22. *Have you the block system for your clinical teaching of obstetrics?* Yes—20, No—16. Are courses and hours in Internal Medicine disproportionately great as compared with obstetrics? Yes—12, No—24. *Are courses and hours in surgery disproportionately great as compared with obstetrics?* Yes —24, No—10, Questionable—2.

COMMENTS OF HEADS OF DEPARTMENTS

It is of interest to note the various comments of Heads of Departments appended to the replies from questionnaires. Following is a summary of their expressions:

1. No student should be permitted to take the State Board Examination until he has completed several months of maternity service.

2. A longer required maternity service for students is essential.

3. Conditions would be improved by "trying to impress upon medical school administrators that obstetrics is an art, not a joke."

4. More money is needed to pay Junior full-time men.

5. All schools should have a Maternity Hospital connected with the University Hospital where students may reside. Increase of obstetric beds absolutely controlled by the schools, in a separate building but in direct physical connection with the University Hospital. Greater effort on the part of the obstetric department in the training of teachers and research workers.

6. More time for better teaching and for practical work.

7. More free beds and more patients to fill them.

8. Full-time instructors on indoor and outdoor services.

9. Fewer home deliveries or even none, and more opportunity for hospital training.

HOSPITALS

In order to secure information on the length of time interns spend in the obstetric service and the amount and kind of obstetric teaching material available in hospitals, questionnaires were sent to a large number of hospitals throughout the country. There were 241 replies suitable for tabulation from general hospitals with an obstetric

service. One hundred and eighty-one of these are on the list of hospitals approved for internships by the Council on Medical Education and Hospitals of the American Medical Association and comprise a little more than one-fourth of the hospitals included on that list. It is thought, therefore, that the data given, which are for the year 1929, are fairly representative.

The hospitals were divided into four groups for purposes of tabulation as follows: Group I, those having less than 300 deliveries during the year; Group II, those having 300 to 599 deliveries; Group III, those having 600 to 999 deliveries, and Group IV, those having 1000

TABLE III.   OBSTETRIC INTERNSHIPS IN GENERAL HOSPITALS

HOSPITALS GIVING SPECIFIED INFORMATION RELATING TO INTERNSHIPS IN OBSTETRICS	LENGTH OF OBSTETRIC SERVICE AND NUMBER OF DELIVERIES PER INTERN IN HOSPITALS GROUPED ACCORDING TO NUMBER OF DELIVERIES			
	GROUP I. HOSPITALS HAVING LESS THAN 300 DELIVERIES	GROUP II. HOSPITALS HAVING 300 TO 599 DELIVERIES	GROUP III. HOSPITALS HAVING 600 TO 999 DELIVERIES	GROUP IV. HOSPITALS HAVING 1000 TO 2000 DELIVERIES
Number of hospitals in each group	57	107	50	27
Number of deliveries in these hospitals	11,678	45,084	38,252	35,709
Number of hospitals offering rotating internships, reporting on number of deliveries and number of interns	56	92	47	19
Number of deliveries in these hospitals	11,478	38,967	35,951	24,588
Number of interns	270	578[1]	396[1]	382
Number of hospitals offering rotating internships, reporting on number of interns on staff and length of intern's service in obstetrics[2]	43	79	41	18
Average length of obstetric service per intern	2.6 mo.	2.3 mo.	2.5 mo.	1.8 mo.
Average length of obstetric service per hospital	3.6 mo.	3.0 mo.	2.5 mo.	2.4 mo.
Number of deliveries per intern if all interns took obstetric service:				
Minimum number per intern in any hospital	11	9.	24	17
Maximum number per intern in any hospital	149	272	309	300
Number of hospitals having specified number of deliveries per intern:				
Less than 25	12	7	1	1
25 to 49	7	15	3	3
50 to 99	23	32	10	3
100 to 199	1	22	23	8
200 and over	–	3	4	3

[1]Includes 3 residents in one hospital which had residents instead of interns.
[2]In a few instances the service in obstetrics was combined with gynecology or surgery, but in most cases there was a service in gynecology in addition to the obstetric service.

to 2000 deliveries. In the discussion the groups are referred to by number. Tables IV and V show the main points in the tabulation.

Type of Internship.—In the absence of specific information to the contrary, all internships were classed as "rotating," using the term in a broad sense to cover all hospitals not giving "straight services." Only 17 hospitals indicated on their questionnaires that they offered a "straight service" in obstetrics, or in obstetrics and gynecology combined. As might be expected, 7 of these were in Group IV.

In most of the hospitals giving rotating internships there was a service in gynecology, or in gynecology and surgery combined, in addition to the service in obstetrics; 12 hospitals reported obstetrics combined with gynecology, and in two others it was combined with something else. A few hospitals made no report or else gave indefinite replies.

Length of Intern's Service in Obstetrics and Number of Deliveries per Intern.—

Averages were made for the following items:

1. Length of the obstetric service per intern in those hospitals with a rotating service that reported on both the number of interns and the length of the obstetric service. This average varied from 1.8 months for interns in the hospitals in Group IV to 2.6 months for interns in the hospitals in Group I. (See discussion below.)
2. Length of the obstetric service per hospital. This average ranged from 2.4 months for the hospitals in Group IV to 3.6 months for those in Group I.
3. Average number of deliveries per intern.

The averages on number of deliveries per intern and the one on the length of time each intern spent on the obstetric service were made on the assumption that every intern took the obstetric service. Undoubtedly they did not, so these are minimum figures and the averages both of the length of each intern's service and the number of cases per intern would be higher if the exact number of interns taking the obstetric service were known.

The number of deliveries which it would be possible for each intern to assist with, deliver, or at least observe, if all the cases could be equally apportioned among all interns and if all interns took the obstetric service, was calculated for each hospital. There were 181 hospitals with rotating internships that gave the necessary information. Of these, there were only 21 hospitals in which there were less than 25 deliveries per intern; in 28 hospitals there were 25 to 49 deliveries per intern; in 68 hospitals there were 50 to 99, and in 64 hospitals the number was 100 or more, being 200 or more in ten of them. The minimum average number of deliveries per intern in any hospital was 9; the maximum was 309. The average of 9 per intern was in a hospital that gave a one-month service in obstetrics and had

TABLE IV. CASES OF COMPLICATIONS OF LABOR IN HOSPITALS

COMPLICATIONS OF LABOR	NUMBER OF CASES, MAXIMUM, MINIMUM, AND AVERAGE IN HOSPITALS GROUPED ACCORDING TO NUMBER OF DELIVERIES			
	GROUP I. HOSPITALS HAVING LESS THAN 300 DELIVERIES	GROUP II. HOSPITALS HAVING 300 TO 599 DELIVERIES	GROUP III. HOSPITALS HAVING 600 TO 999 DELIVERIES	GROUP IV. HOSPITALS HAVING 1000 TO 2000 DELIVERIES
Hyperemesis:				
Number of hospitals reporting on this item	45	80	33	23
Number of hospitals reporting no cases	5	7	4	—
Minimum number of cases in any hospital	1	1	1	2
Maximum number of cases in any hospital	25	20	115	40
Average per hospital	4.5	5.5	10.5	15.2
Eclampsia:				
Number of hospitals reporting on this item	50	97	37	25
Number of hospitals reporting no cases	4	4	—	—
Minimum number of cases in any hospital	1	1	1	1
Maximum number of cases in any hospital	17	26	15	42
Average per hospital	4	4.4	5.2	11.6
Other Toxemias:				
Number of hospitals reporting on this item	44	80	35	24
Number of hospitals reporting no cases	11	6	2	—
Minimum number of cases in any hospital	1	1	1	1
Maximum number of cases in any hospital	14	129	81	194
Average per hospital	13	10.1	13.2	36.3
Placenta Previa:				
Number of hospitals reporting on this item	47	90	40	25
Number of hospitals reporting no cases	2	8	1	—
Minimum number of cases in any hospital	1	1	1	2
Maximum number of cases in any hospital	8	12	32	36
Average per hospital	2.7	2.7	5	8.1
Ablatio Placentae:				
Number of hospitals reporting on this item	31	61	25	22
Number of hospitals reporting no cases	22	28	9	1
Minimum number of cases in any hospital	1	1	1	1
Maximum number of cases in any hospital	2	5	7	35
Average number of cases per hospital	0.4	1	1.9	7.1

TABLE IV—CONT'D

COMPLICATIONS OF LABOR	NUMBER OF CASES, MAXIMUM, MINIMUM, AND AVERAGE IN HOSPITALS GROUPED ACCORDING TO NUMBER OF DELIVERIES			
	GROUP I. HOSPITALS HAVING LESS THAN 300 DELIVERIES	GROUP II. HOSPITALS HAVING 300 TO 599 DELIVERIES	GROUP III. HOSPITALS HAVING 600 TO 999 DELIVERIES	GROUP IV. HOSPITALS HAVING 1000 TO 2000 DELIVERIES
Postoperative Hemorrhage:				
Number of hospitals reporting on this item	40	75	35	22
Number of hospitals reporting no cases	8	9	6	1
Minimum number of cases in any hospital	1	1	1	1
Maximum number of cases in any hospital	18	21	22	50
Average number of cases per hospital	2.7	3.4	3.9	14.0
Uterine Rupture:				
Number of hospitals reporting on this item	33	61	28	23
Number of hospitals reporting no cases	25	47	16	10
Minimum number of cases in any hospital	1	1	1	1
Maximum number of cases in any hospital	1	3	3	15
Average number of cases per hospital	2.4	0.3	· 0.7	1.4
Contracted Pelves:				
Number of hospitals reporting on this item	35	76	29	19
Number of hospitals reporting no cases	5	15	2	–
Minimum number of cases in any hospital	1	1	1	5
Maximum number of cases in any hospital	33	42	80	429
Average number of cases per hospital	6	5	11.1·	75.5
Abortions:				
Number of hospitals reporting on this item	36	65	26	17
Number of hospitals reporting no cases	–	2	–	–
Minimum number of cases in any hospital	1	1	2	15
Maximum number of cases in any hospital	97	141	169	840
Average number of cases per hospital	32.6	47	84.1	139.4

TABLE IV—CONT'D

COMPLICATIONS OF LABOR	NUMBER OF CASES, MAXIMUM, MINIMUM, AND AVERAGE IN HOSPITALS GROUPED ACCORDING TO NUMBER OF DELIVERIES			
	GROUP I. HOSPITALS HAVING LESS THAN 300 DELIVERIES	GROUP II. HOSPITALS HAVING 300 TO 599 DELIVERIES	GROUP III. HOSPITALS HAVING 600 TO 999 DELIVERIES	GROUP IV. HOSPITALS HAVING 1000 TO 2000 DELIVERIES
Puerperal Infections:				
Number of hospitals reporting on this item	24	45	19	14
Number of hospitals reporting no cases	9	14	4	2
Minimum number of cases in any hospital	1	1	1	2
Maximum number of cases in any hospital	42	130	91	221
Average number of cases per hospital	4.6	7.5	7.7	32.6
Ectopic Gestation:				
Number of hospitals reporting on this item	42	87	33	22
Number of hospitals reporting no cases	6	4	2	2
Minimum number of cases in any hospital	1	1	1	2
Maximum number of cases in any hospital	13	24	31	61
Average number of cases per hospital	3.5	5.4	9.9	14.8

41 interns. It is more than likely that all the interns did not take the obstetric service so that the actual average would be higher than 9. The average of 309 deliveries per intern was in a hospital that gave a four-months' service in obstetrics and gynecology combined and had only four interns on the staff.

These figures show that in most hospitals there are enough obstetric cases available for each intern to receive adequate experience in the conduct of normal labor provided he is given an opportunity to observe, assist at, and conduct deliveries under competent direction. His judgment and skill at the end of his internship will depend largely upon the efficiency of this direction.

Complications of Labor.—Eleven complications of labor were listed on the questionnaire and each hospital asked to report the number of such cases it had during the year. The number of hospitals giving data on the various complications, the minimum and maximum number of cases reported by any hospital and the average are shown in Table IV. In considering the figures, the number of hospitals reporting on each item and the relation of this number to the total number of hospitals in the group as shown in Table III should be kept in mind.

It is quite probable that some of the hospitals that made no report on the number of cases of certain complications of labor had no cases

of that type, but of course this could not be taken for granted and only the hospitals that made a definite report were counted in the tabulation.

While the maximum number of cases of the specified complications of labor in any hospital is high in many instances, this maximum is frequently far above the number reported by any other hospital in the group. It will be observed that the minimum figure in most cases is one. Usually there were several hospitals that had this minimum number of cases and several more with only 2, 3, or 4 cases.

From the number of hospitals reporting that they had no cases of certain types of complications, the small average number of cases per hospital for many complications, and the average length of the

TABLE V.　OPERATIVE DELIVERIES IN HOSPITALS

OPERATIVE DELIVERIES	NUMBER OF CASES, MAXIMUM, MINIMUM, AND AVERAGE NUMBER, AND HIGHEST AND LOWEST PERCENTAGE IN HOSPITALS GROUPED ACCORDING TO NUMBER OF DELIVERIES			
	GROUP I. HOSPITALS HAVING LESS THAN 300 DELIVERIES	GROUP II. HOSPITALS HAVING 300 TO 599 DELIVERIES	GROUP III. HOSPITALS HAVING 600 TO 999 DELIVERIES	GROUP IV. HOSPITALS HAVING 1000 TO 2000 DELIVERIES
Forceps Deliveries:				
Number of hospitals reporting on this item	45	93	41	26
Number of hospitals reporting no cases	–	–	–	–
Minimum number of cases in any hospital	1	5	16	17
Lowest percentage of deliveries by forceps in any hospital	0.5	1.4	2.5	1.2
Maximum number of cases in any hospital	101	268	760	465
Highest percentage of deliveries by forceps in any hospital	64.7	73.3	62.3	38.8
Average number of cases per hospital	37.5	71.7	145.4	215.3
Versions:				
Number of hospitals reporting on this item	46	92	40	26
Number of hospitals reporting no cases	3	2	–	–
Minimum number of cases in any hospital	2	1	2	4
Lowest percentage of deliveries by version in any hospital	0.7	0.2	0.3	0.4
Maximum number of cases in any hospital	168	74	248	571
Highest percentage of deliveries by version in any hospital	56.7	14.8	28.6	28.5
Average number of cases per hospital	9.8	11.1	24.7	39.2

TABLE V—CONT'D

OPERATIVE DELIVERIES	NUMBER OF CASES, MAXIMUM, MINIMUM, AND AVERAGE NUMBER, AND HIGHEST AND LOWEST PERCENTAGE IN HOSPITALS GROUPED ACCORDING TO NUMBER OF DELIVERIES			
	GROUP I. HOSPITALS HAVING LESS THAN 300 DELIVERIES	GROUP II. HOSPITALS HAVING 300 TO 599 DELIVERIES	GROUP III. HOSPITALS HAVING 600 TO 999 DELIVERIES	GROUP IV. HOSPITALS HAVING 1000 TO 2000 DELIVERIES
Classic Cesarean Sections:				
Number of hospitals reporting on this item	47	97	43	27
Number of hospitals reporting no cases	4	3	–	–
Minimum number of cases in any hospital	1	1	2	1
Lowest percentage of deliveries by classic cesarean section in any hospital	0.5	0.2	0.2	0.1
Maximum number of cases in any hospital	21	51	61	183
Highest percentage of deliveries by classic cesarean section in any hospital	10.4	9.8	7.3	14.1
Average number of cases per hospital	5.2	9.2	18.3	24.0
Cervical Cesarean Sections:				
Number of hospitals reporting on this item	26	47	17	17
Number of hospitals reporting no cases	22	31	7	4
Minimum number of cases in any hospital	1	1	1	2
Lowest percentage of deliveries by cervical cesarean section in any hospital	0.4	0.2	0.1	0.1
Maximum number of cases in any hospital	8	15	48	66
Highest percentage of deliveries by cervical cesarean section in any hospital	4.0	2.7	5.1	5.0
Average number of cases per hospital	0.5	1.8	7.4	16.3

obstetric service in a rotating internship, it is obvious that most interns will see but few of the complications of labor with the exception of the more common types such as abortion, puerperal infection, and toxemia, and will receive still less experience in the management of such cases. This is borne out by the replies received from recent graduates (Table II).

Fifty-nine hospitals made a report on each one of the eleven complications of labor listed on the questionnaire. Only 7 of them had cases of all eleven types of complications during the year, and a few more had cases of all types except uterine rupture. From this it may be concluded that in but few hospitals will an intern have an opportunity to see all these types of complications of labor even during a

year's internship in obstetrics, and during a rotating internship the opportunity for such experience is largely a matter of chance.

The small averages per hospitals of some of the complications of labor are causes for congratulation. One of the objectives of improved obstetric practice is a further reduction in all of them. In the ordinary course of events each general practitioner will have but few cases of the less frequent complications of labor in his years of practice. The question is how to give him training and experience to enable him to recognize these cases early and to manage them successfully.

The value of using demonstration material to supplement lectures on complications of pregnancy while the student is in the medical school is obvious. In hospitals giving the fifth or intern year of medicine, there should be better organization for teaching, which should include more or less formal instruction by means of conferences, manikin work, moving pictures, charts and slides. Interns expecting to include obstetrics in their practice should be given a major service in this branch. Others need only the minimum. Complicated cases in hospitals should be called to the attention of all interested interns.

There are more than 3500 general hospitals in the United States which are registered by the American Medical Association but not approved for general rotating internships. A number of these have 150 to 400 or more births annually. The possibility of developing special internships of three months or more in the obstetric departments of these hospitals suggests itself as a means of giving additional experience to those interns who wish to include obstetrics in their practice and who receive only a limited amount of obstetric training during their rotating internships. Such services would need to be under the direction of a competent obstetrician.

Operative Deliveries.—There is no dearth of operative deliveries in hospitals and the intern who does not have an opportunity to see a large number of forceps deliveries, at least, will be the exception rather than the rule. The danger seems to be that operative deliveries will be overemphasized in the intern's training and that he will fail to appreciate the importance of conservative obstetrics. A proportion of one-fourth, one-third, or one-half of the deliveries by operative procedures was not uncommon. In one hospital with 867 deliveries, 644 or 74.3 per cent had been by forceps, version, or cesarean section. This hospital is on the list of hospitals approved for internships and had six interns.

Two hundred and five hospitals reported on the number of forceps deliveries: 204, the number of versions, 214, the number of classic cesarean sections, and 107, the number of cervical cesarean sections. Only 27 hospitals in the entire number reported having less than 20 forceps deliveries during the year. Five hospitals reported no deliv-

eries by version, 7 none by classic cesarean section, and 63, none by cervical cesarean section. The minimum and maximum number, the lowest and highest percentage in any hospital, and the average per hospital are shown in Table V.

COMMENTS OF THE COMMITTEE

Instruction in obstetrics to medical students is a desideratum of prime importance in the determination of maternal morbidity and mortality. The better the clinical training of students in the art of obstetrics the better obstetrics they will practice and this, in turn, will be reflected in improved results. Didactic teaching of obstetrics, in the United States, is and has been fairly satisfactory, save that it has been overstressed in many schools for want of clinical material. The need is not for less theory but for more clinical instruction. Our maternal mortality rate exceeds that of any and all continental countries; it exceeds that of Canada and some of the Republics of South America, in short it is the highest of the civilized world. We could go far in correcting this disgraceful state of affairs if our teaching institutions would provide adequate facilities for clinical instruction in obstetrics. The American Medical Association estimates that there are 700,000 women delivered in hospitals annually. This would indicate a wealth of clinical material not available for teaching purposes. The need is for *more maternity beds* and for more patients available for teaching. To fulfill this want the administrative bodies must manifest greater zeal in providing needed facilities. They cannot expect the public to take the initiative in developing maternity hospitals. There is evidence on every hand that such sentiment is being created in administrative circles. In recent years a limited number of excellent maternity hospitals have been erected in conjunction with teaching institutions and in most schools there have been added hours allotted to the teaching of clinical obstetrics. The American Gynceological Society, the American Association of Obstetrics, Gynecology and Abdominal Surgery, the Section of Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association are uniting in making overtures to the Council of Medical Education for a larger recognition of obstetrics in the curricula of our medical schools. As yet they have not received satisfactory consideration from the council. These same organizations have recently inaugurated "The American Board of Obstetrics and Gynecology" for the purpose of raising the standard of obstetric and gynecologic practice in America. Much has been accomplished—more is urgently demanded if obstetrics is to receive recognition on a parity with medicine and surgery. We urge upon the administrative faculties of our educational institutions that obstetrics receive equal recognition with general surgery. Such is its

relative importance in the general practice of medicine and such should be its place in the medical curriculum.

There is much in the findings of the Committee on Undergraduate Teaching of Obstetrics to lend encouragement. We note with satisfaction that the departments of obstetrics and gynecology are combined in about half of the schools answering our questionnaires and that approximately 80 per cent of the Deans of medical schools favor the combined chair. It would seem that in the near future our medical schools will be fully committed to this logical and desirable arrangement. It is effective for didactic and administrative purposes and will result in a greater appreciation of the importance of combining the two specialties in practice.

It is gratifying to note that almost without exception the Heads of Departments are practitioners in their special field. This should insure greater emphasis on clinical teaching.

The correlation of the teaching of the basic sciences with the teaching of obstetrics and gynecology is a difficult problem. It is not satisfactorily solved in most of our medical schools. This important problem should receive the consideration to which it is entitled. The application of the basic sciences to obstetrics can only be satisfactorily taught by a qualified obstetrician.

The committee would emphasize the importance of a resident maternity service for undergraduates and graduates. A well-ordered maternity service with sufficient clinical material is the *sina qua non* of the clinical teaching of obstetrics. There is no adequate substitute. The ideal would be a detached maternity hospital in close proximity to the university hospital and under university control. Only a very limited number of our schools can boast of such equipment.

It is contended by some that with a well-ordered dispensary, where prenatal and postpartum observations may be followed up, a dispensary as an organic part of a maternity hospital, there would be no need to adhere to the long-established custom of sending students into the home for deliveries and postpartum supervision. This plan does not meet with the approval of all members of the committee. However, the lack of adequate dispensary and maternity hospital facilities is no justification for the continuance of an outdoor student service when it implies that untrained students, ignorant of the rudiments of clinical obstetrics, are permitted to deliver patients in the home, unattended by an experienced obstetric teacher. If the school cannot provide a maternity service for their students, then it would be better for their clinical training in obstetrics to be deferred to their intern service. To send a student into the homes of the poor, unattended by a competent clinician, is a menace to the public and a travesty on pedagogy. There are a number of medical schools without a maternity hospital and located in small communities where any

considerable out-patient service is impossible. Such schools might well require a hospital year before granting an M.D. degree and in this hospital year a maternity service would be required. It is questionable if there is any more justification for requiring of the student body the responsibilities in obstetric practice than that they perform a given number of surgical operations. Let us speed the day when dispensaries and maternity hospitals will supply all needed clinical material.

It is the opinion of the committee that instruction should be given to the student body in contraceptive methods and the therapeutic indications thereof. Moreover, it is the opinion of the committee that the students should be given special instruction in the management of abortions.

If there is one universal complaint expressed by the Heads of Departments it is the need of sufficient clinical material for teaching purposes. It is surprising to note that with all this need there is not made more general use of charts, slides, movies, and specimens. Even the manikin courses are too often curtailed or not given at all. Such useful adjuncts to teaching would go far in compensating for the lack of clinical material.

Finally we would stress the importance of prenatal and postpartum clinics. Nearly all Heads of Departments lay claim to such clinics but it is apparent from reports at hand that, with few exceptions, these clinics have not been developed to the extent justified by their importance. Maternal morbidity and mortality could be more than halved by efficient prenatal, intranatal and postpartum supervision. The students should not be denied the opportunity to acquire this much-needed training. The responsibilities of the obstetrician begin from the date of conception and are not at an end until mother and child are made whole and sound.

Preventive medicine has worked wonders in reducing the mortality rate in internal diseases. There is need for similar activity in the field of obstetrics. The development of more and still more teaching maternity hospitals for the better training of medical students, nurses, and midwives in the art of obstetrics, and the intelligent cooperation of the lay public and profession in the care of the expectant mother will do for obstetrics what preventive medicine has done in the general field of medicine.

Happily, we are experiencing an awakening of interest in the preventive phase of obstetrics. We find the leaders in the field of obstetrics stressing the need of vigilant prenatal care. It is this preventive phase of activity that gives promise of placing obstetrics more nearly alongside of medicine and surgery in the onward progress of our science.

The maternal and fetal death rates are partly attributable to the lack of prenatal and other maternity supervision and with no desire to absolve the physician from his responsibilities in prenatal supervision we are of the opinion that the blame rests in part upon the women themselves. Through various campaigns of education conducted by numerous agencies they have had opportunity to know of its importance, yet they are too often indifferent and neglectful. And so the expectant mother disregards instruction, unmindful of the pitfalls that await her. Not until women appreciate the serious aspects of childbirth will they demand that expert guidance which the specialty requires.

We are told that the mortality rate is higher in the cities than in the rural districts; that it is appallingly high among the colored race and that the sparsely settled districts, where facilities are meager or altogether wanting and doctors are few, are suffering by comparison with more thickly populated districts. We are told on competent authority that puerperal sepsis ends fatally in 50 per cent more cases in the cities than in rural districts where surgical interference is less in vogue.[1] Frederick Rice finds the average maternal mortality rate from sepsis in cities to be three per thousand live births and in rural districts 1.9 per thousand live births.[2] These are thought-provoking statements which should come to us as a challenge. More than half, if not three-fourths, of maternal fatalities, are preventable. Are we to lag behind in the onward march of preventive medicine? The awakening of general interest in prenatal care, the masterly leadership of men and institutions as evidenced here and there and the organized efforts to ascertain facts by such organizations as the White House Conference on Child Health and Protection afford abundant evidence that the time is not far distant when we will make a better accounting of our stewardship.

Our high maternal mortality is not the only urge for better undergraduate teaching of obstetrics. We are confronted with the problem of early infant mortality and stillbirths which are likewise chargeable, in no small degree, to the lack of adequate clinical instruction in obstetrics. The reports of the U. S. Bureau of the Census for 1925-29 inclusive, show a mortality in the first day of infant life of 15.0 in 1925 as compared with 15.3 in 1929; in the first week of infant life of 28.0 in 1925 as compared with 28.1 in 1929 and in the first month of infant life of 37.8 in 1925 as compared with 36.9 in 1929. The rates are for the expanding birth registration area and are made on a basis of 1,000 live births. We observe that not only is the early infant mortality excessive but that there has been no improvement in the years 1925-29. The record of stillbirths, from the same source for

[1] Miller, Jeff: South. M. J. 19: 882, 1926.
[2] New York State M. J. 29: 262, 1929.

the years 1925-28 inclusive, per 1,000 live births, shows an incidence of 36 stillbirths in 1924 as compared with 35 in 1928 in the white population and of 76 in 1924 as compared with 81 in 1928 in the colored population.

With all the restrictions placed on medical practice we still find obstetrics the one specialty of medicine in which nongraduates are permitted to practice. While progress has been impeded by the attitude assumed by the medical profession and laity alike in regarding childbirth as a physiologic process, we have even more grievously erred in the assumption that childbirth is a pathologic process. The latter view has led to unwarranted and meddlesome interference and is responsible in no small degree for our deplorable results. The only reasonable and sane position to assume is to regard childbirth, not as an event so natural and devoid of danger as to be regarded with indifference, nor yet so abnormal, as to place it in the category of a surgical specialty. Rather should it be regarded as a process of such intrinsic importance as to call for unceasing vigilance, for masterly inactivity matched with timely thought-controlled interference.

While this report has to do with the undergraduate teaching of medical students we are not unmindful of the need for larger and better clinical facilities for the instruction of graduate medical students, nurses, and midwives. All must share in the benefits of augmented clinical facilities if we are to make any notable improvement in our results.

RECOMMENDATIONS OF THE COMMITTEE

1. Unification of the departments of obstetrics and gynecology in medical schools and in all hospitals affiliated with and controlled by the university.

2. All members of the teaching staff should be qualified obstetricians and gynecologists.

3. The extension of special pathology laboratory courses, manikin demonstrations and clinical clerkships.

4. More liberal use of charts, models, specimens, lantern slides, and movies.

5. Better correlation of the teaching of the basic sciences with the teaching of obstetrics and gynecology.

6. A rotating internship of one year, embracing a satisfactory maternity service, should be required for the licensure for the practice of medicine. It is recommended that an effort be made in all states to secure such legislation.

7. There should be larger opportunities for witnessing complicated cases.

8. The reasonable number of cases for students to participate in delivery under adequate supervision is not less than 25.

9. All student deliveries in the home should be supervised by a teaching obstetrician. Instruction to the students to call for help ''when needed'' is not adequate supervision.

10. The bloc system for teaching clinical obstetrics.

11. The development of larger and better prenatal and postpartum clinics.

12. More liberal allotment of teaching hours in clinical obstetrics. Teaching hours and facilities should be on a parity with general surgery.

13. Adequate facilities for clinical instruction in obstetrics and detailed instruction in preconceptional, prenatal, intranatal, and postnatal care, preferably in an isolated maternity building, in close proximity to the university hospital and under university control.

14. The development of plans whereby more of the obstetric cases in hospitals not now used for teaching may be made available for that purpose.

15. The committee indorses the recommendation of the American Association of Medical Colleges that 5 per cent of the total hours required for graduation and degree be devoted to instruction in obstetrics.

16. There is need for the general adoption of a comparable form in the catalogues of medical schools which will obviate confusion and insure greater accuracy and completeness.

GRADUATE EDUCATION OF PHYSICIANS IN OBSTETRICS*

By Rudolph W. Holmes, M.D., Chicago, Ill.

THERE is a very intimate relationship between the type of under-
graduate and graduate teaching in obstetrics. If the student has
been poorly educated in his undergraduate years he does not present
the malleability requisite for the making of a finished scholar in
graduate work. Both must be of high order if productive results are
to be assured.

There were but two or three places in the United States at the be-
ginning of this century where the ambitious young graduate could
go for postgraduate courses in obstetrics—of a sort. If he wished to
secure ample opportunity he needs must have traveled to Europe.
The survey made by the Committee on Obstetric Education of Physi-
cians demonstrates that to this day the opportunities for a man wish-
ing to obtain advanced work in obstetrics in this country are not suf-
ficient.

There is still a serious problem facing us in the attempt to formu-
late rules for a minimal standard of undergraduate teaching—the
number of hours of didactic work, demonstrations, and comprehensive
clinical instruction, so that there will be a balanced correlation be-
tween the component divisions of the departmental teaching, as well
as a correlation between the elements of all departments, one to an-
other. It would be productive of more ideal results if all the Class A
medical schools would devise such a productive system that compar-
able values would be placed on their diplomas: coercion by the 48
varieties of legislative action robs the schools of their initiative and
the opportunity of having a common standard. In the same manner
the colleges which are offering graduate courses should devise rules
for the determination of what constitutes minimal standards for the
different types of graduate teaching.

* * * *

CLASSIFICATION OF GRADUATE TEACHING

There are various methods followed in giving advanced instruction
to physicians, all of which serve a most valued and useful purpose, but
each one has an ultimate end, widely divergent one from another.
Some are merely short courses which inspire the students to higher
aims and ideals and are preeminently practical in intent. Others give
a most comprehensive survey of the whole field of medicine. Others

may be limited in scope with the intent of producing specialists in specific medical fields, teachers, or investigators. A course which purports to prepare a man for advanced standing as a clinician and teacher of obstetrics should have some survey of all medical specialties which are connated directly or indirectly to obstetric practice. A physician may practice dermatology, ophthalmology, urology, laryngology, etc., even general medicine and surgery with a meager knowledge, practical or theoretical, of obstetrics: such specialists will have slight contact with the childbearing conditions. On the other hand, the obstetrician constantly comes in contact with each and every complication which peculiarly is germane to some individual specialty.

There has been much misconception, and therefore confusion, by indiscriminate use of terms applied to advanced medical teaching. The Committee on Medical Education and Pedagogics of the Association of American Medical Colleges has presented definitions which fairly adequately cover our needs. These are as follows:

Postgraduate Medical Study.—Postgraduate medical study is that ordinarily done under other than University direction in medical subjects by graduates in medicine. If under University direction, it is usually in the Extension Division. Its methods are varied, but much of it is done through hearing lectures and witnessing demonstrations. Its chief characteristic is further training in the practice of medicine. Research is not a factor. The course is usually brief—from one week to six months —but may extend to one year. University degrees may be granted, or proper diplomas or certificates may be obtained. (The term postgraduate is not desirable, but it is so well fixed by usage both in America and Europe that there seems no probability of displacing it.)

Graduate Medical Study.—Graduate medical study is special medical study in a university in selected public health, medical science, or clinical subjects. It is under the direction of the school of public hygiene, or school of public health, or the general graduate school, or the graduate medical school, or the graduate department of the medical school. One academic year devoted to the study of a single (convention) medical subject is the minimal matriculation period, and constitutes credit toward a graduate university degree, maturing within a minimum of two academic years for a master's degree, and within a minimum of three such years for a doctorate degree.

These definitions are accepted as valuable descriptive outlines for courses, and their application limited to obstetric teaching in this report. Wherever "obstetric teaching" is used it includes so-called gynecology as an integral part of such obstetric pedagogy. From the anatomic, embryonic, physiologic, and pathologic standpoint they are one and indivisible. From a clinical point they should be completely unified.

The Committee on Obstetric Education of Physicians has endeavored, by means of questionnaire studies, research and correspondence to secure data, as nearly complete as possible, on the postgraduate and graduate teaching in obstetrics, which is being done in the United States. The following is a summary of its findings.

POSTGRADUATE TEACHING

For purposes of this report postgraduate teaching in obstetrics may be separated into the following groups:

1. Extension Courses: under the auspices of a University Medical School, or Medical Society, or State Board of Health.

2. Courses given by Medical Societies, or other organizations. Commonly, a well-balanced, comprehensive program is provided in which obstetrics is but a part.

3. Residencies in obstetrics and gynecology in a hospital.

4. Brief Intramural (University Control) Courses in Obstetrics, possibly with some instruction in subjects germane to obstetrics.

It is recognized that any of the above types of teaching may be designed to form part of a graduate course. This is particularly true of a residency which is frequently the first year of a graduate course. At the present time, however, with the exception of residencies, practically none of the work in the above classifications is graduate work.

EXTENSION COURSES IN OBSTETRICS

A survey made by the committee indicates that there have been more or less active endeavors to give some extension courses in obstetrics in ten states, California, Florida, Georgia, Iowa, Kansas, Kentucky, Maryland, New York, Oklahoma, and Wisconsin. This work usually has been under the auspices of the Medical School and the Extension Division of the State University of the State Board of Health, in cooperation with State and local medical societies. Briefly the details of the work and the opinions concerning it are as follows:

In Maryland and New York, series of 5 lectures have been given in a few communities without a definite class formation. In Maryland the work has been done by members of the University of Maryland, aided by financial subsidies from the Bureau of Child Hygiene of the Department of Health. The instructors receive no additional compensation for this extramural work. In New York, 17 lecture courses, of 5 periods each, covered 27 counties during the period from April, 1926, to May, 1929. These courses were conducted by the Division of Maternity, Infancy, and Child Hygiene of the State Department of Health, cooperating with the Committee on Public Health and Medical Education of the State Medical Society. They were financed by State and Federal appropriations made available under the Federal Maternity and Infancy Act. The Committee on Public Health and Medical Education of the New York State Medical Society felt that these courses are so valuable that they have made arrangements to give a six-lecture course in obstetrics to local groups. There was no cost to the physicians who attended the lectures in either state.

Wisconsin, through the activities of the Extension Division of the State University, has been giving extension courses in medicine, though the work to date in obstetrics has been limited to one-lecture courses in the several communities. This activity is supplemented by a traveling library, whereby physicians, at a minimal cost, may borrow obstetric and gynecologic textbooks as well as works on general medicine. There is a tentative plan for a more extended course next year.

The California and Kentucky work has consisted of one or two lectures to each community group. In Kentucky the necessary equipment for demonstrations was provided.

In five states, namely, Florida, Georgia, Iowa, Kansas, and Oklahoma, classes have been organized and formal courses given. The first course was given in Georgia, 1929. Florida now has a course in progress (January, 1931). The courses in both states were under the auspices of the State Board of Health and State Medical Society. They were given by a member of the faculty of the Medical School of Emory University who is a part-time member of the staff of the Federal Children's Bureau: the latter financed the activity. Classes were organized in various communities throughout the state, no community that desired the work being considered too small to make the lessons a success. The lecturer spent a week in each community, giving a course of five lectures, supplemented by slides, moving pictures, and manikin demonstrations. No fees were required from the physicians attending, as the cost of the work was borne by a Federal Government agency.

In Iowa, Kansas, and Oklahoma, the courses were sponsored by the Extension Divisions of the State Universities in conjunction with the Medical Schools. Class groups were organized by the Extension Division in five or six strategic centers within driving distance of each other, and located approximately in a circle. The towns in which the courses were to be given were selected on account of their availability to physicians located in contiguous communities. Lectures and clinics or demonstrations were given once a week in each center for nine or ten weeks. The courses were practically self-supporting, being financed by the fees paid by the enrolled physicians. The organization costs, which were small, were defrayed by the Extension Division of the State University.

The consensus of opinion was that the extension plan, the so-called circuit courses, offers ideal means for the improvement of obstetric practice. Too, this is the most economical method of bringing practical knowledge to physicians that has yet been devised, both from the standpoint of the organization conducting the course as well as the expense which the physician must bear. It is a serious matter to take a physician away from practice for a period with the economic losses, and the augmented expenses while away from the center of his activities. The influence for good is self-evident as the teacher sees and has intimate contact with some five or six groups of physicians each week. The great advantage of this method of instruction is that the subject matter is brought to the physicians as a home problem, in their home community, whereas, if they go to the medical centers they get the instruction from the environment and equipment of the University, tinctured by the University method of conducting affairs. Letters received from the instructors and others participating in the organization of the circuit course extol the advantages of the method; in every way obstetrics may be taught with brilliant success; also, it was the consensus of opinion that the plan offers the best means of improving the general practice of obstetrics. More physicians may be reached in a shorter period of time than by any other means, and with a minimal cost to the participants. One instructor is able to meet six groups of physicians each week. In North Carolina, courses in pediatrics were given in 24 centers in one summer, demonstrating the

possibility of covering an entire state in this period of time. The possibility, and the desirability, of doing the same with obstetrics is self-evident.

One point particularly emphasized by those replying to the questionnaire was the importance of exercising great care in the selection of instructors, as the success of the course is largely dependent upon the instructor's ability "to put it over." This again accentuates the fact that avid interest and enthusiasm for one's task are worth more than mere equipment. It was pointed out that the experience of one state had shown that it took two or three good courses to counteract the effects of one given by a poor instructor. In this connection, the dearth of suitable instructors received animadvertence: the need was stressed by a central agency which would furnish lists of competent persons from which selections could be made. It naturally follows that the instructor must be a man so situated that he can give the allotted time to the work with a minimal of sacrifice on his part. University teachers are peculiarly appropriately placed for the duties; physicians in private practice, even though they be teachers, hardly may avail themselves of the opportunity to do this good work on account of the loss of private practice. The work was so invaluable, it was felt, by those interested in the activity, that teachers who were altruistically interested in the advancement of obstetric practice would willingly make the sacrifice by giving at least one course, even though the remuneration were not large.

Practically all were agreed that physicians not in private practice within the state should be secured. There were a number of outstanding reasons for this: (1) It avoided any criticism that the State University, or other agency promoting the course, was fostering any individual physician's private practice. (2) It did not arouse fear on the part of the physicians taking the course that the instructor was trying to build up a clientele for himself from the prestige incident to giving the course. (3) A physician from a distance may be freer in expressing views than one who lives near enough to be called in consultation by local physicians or patients. Based upon the above thoughts, the instructors usually have been prominent obstetricians and teachers from outside the state, or when they were residents of the state they came from the faculty of the State University Medical School. The latter received no additional remuneration for conducting the course, though expenses were paid: the former received a salary ranging from $200.00 to $250.00 weekly, with expenses. An automobile was provided if required.

Opinion varied as to how many physicians should be in each group. One instructor stated it graphically when he expressed the opinion that the group should be large enough to be stimulating, and small enough to avoid confusion and interruption. However, relatively

small groups permit a more intimate contact between physicians and instructors. At least 100 physicians should be on a circuit to make the courses self-sustaining. The classes have been held in hotels, schools, or hospitals. The latter is the most satisfactory if clinical material is to be supplied.

The fees have been moderate, ranging from $10.00 to $35.00 for the course: such fees are adequate to cover the cost of the complete circuit. The opinion was expressed by one man that the course should not be free, "for one usually tried to get something out of a thing when he invested money in it."

The success of postgraduate instruction by means of extension courses is shown by the demand for additional courses in the states where the work was initiated. It was stated that there were few instances in which, after attending one course, the individual physicians failed to register for a succeeding one. The merits of this plan of instruction are further evidenced by the fact that at the last meeting of the National University Extension Association a special committee on graduate extension work in medicine was appointed. The aim of the committee is to bring about some national cooperation in the method. It is essential that such a body shall carry on the activities in order that this most invaluable means of educational propaganda and planning may promote similar campaigns in states which have not yet assumed the responsibility.

The following topics have been discussed in the courses though no single one included them all.

Contraceptive advice and sterilization	Malposition
History taking, examination, and instruction of patient	Multiple pregnancy
	Hemorrhages: Abortion
Management of normal pregnancy	Ectopic pregnancy
Minor ailments	Placenta previa and premature detachment of the placenta
Toxemias: Hyperemesis	
Eclampsia	Postpartum hemorrhage
Normal labor and puerperium, management	Prolapsed cord
	Difficult labor
Normal labor	Management of slight disproportion
Puerperal infection	Injuries to the birth canal
Complications of pregnancy	Repair of birth injuries
Forceps delivery	Episiotomy
Breech extraction and version	Blood transfusion
Anesthesia	Cesarean section
Use of pituitrin	Other operations
Asphyxia neonatorum	

COURSES GIVEN BY MEDICAL SOCIETIES OR OTHER ORGANIZATIONS

The Committee did not go into the question of courses given by groups which appropriately come within this category, other than the extension (circuit) courses outlined in the previous section. So far

as is known no attempt has been made to give such courses in obstetrics alone. Certain medical groups have given most excellent opportunities for physicians to refresh themselves in general medicine, and including most, if not all, the specialties. These groups endeavor to supply a well-balanced program which will be instructive to general practitioners. A very outstanding plan is that employed by the Kansas City Southwest Clinical Society which gives a program continuing four or five days in the early Fall of each year. The program is a thoughtfully prepared presentation of important topics covering the principal fields of medicine by means of addresses on vital topics of the day by representative authorities, by lectures, and clinical demonstrations. The scope of their activities may be appreciated when it is stated that some 72 lectures were presented, and an endless array of clinics given at their meeting last October. Obstetrics was one of the most important specialties given attention. Seventeen hours were devoted to obstetric discussions, besides many clinical sessions being held. The obstetric classes were so popular that some two or three times the number of physicians who could be accommodated applied for tickets to the various classes. The fees were nominal, $6.00 for the complete course, or $1.00 for a single lecture. The scope of the conference was so comprehensive, and so perfectly arranged, that their method of postgraduate teaching is worthy of emulation by other medical societies.

Another example of this type of work is that of the Chicago Medical Society which, each summer, plans a two weeks' course on clinical medicine, covering all the specialties. Obstetric clinics are provided, and are supplemented by demonstrations given by the obstetric department of the University of Illinois. The enormous wealth of clinical material of the Cook County Hospital is available for this course.

The obstetric and gynecologic societies, both national and local, at their periodic meetings offer a wealth of instruction to those who are so located that they may attend them. It is a general rule of such organizations that visitors are always welcome to attend the sessions, and some make it a rule that such guests are invited to participate in discussions. The personal contacts as well as the benefit derived from listening to the presentation of papers and discussions are important adjuncts to postgraduate study.

The clinical material in strategic points over the country should be used for courses along the lines of the above two societies: these refresher courses could be made a great boon to physicians within easy reach of such centers of medical activity. It is regrettable that in too many places the clinical facilities are allowed to lie fallow in so far as they pertain to educational purposes.

RESIDENCIES IN OBSTETRICS AND GYNECOLOGY IN HOSPITALS

There are 83 hospitals on the list approved for residencies in specialties by the Council on Medical Education and Hospitals of the American Medical Association which give residencies in obstetrics or gynecology or both. The total number of residencies offered by these hospitals is 166; of which 7 are in gynecology alone, 28 in obstetrics alone, and 131 in obstetrics and gynecology combined. The number of residencies in these specialties in hospitals not on the approved list is not known. The committee appreciates the enormous benefit of this type of experience both to the community and to the doctor in completing his training and preparing him for a specialty. However, this training is more or less of an individual character and not part of an organized effort to promote postgraduate or graduate education in obstetrics, therefore no special study of the postgraduate work offered by means of residencies was made by the committee except in so far as the form part of a more extensive course (see section on Graduate Education).

BRIEF INTRAMURAL COURSES (UNIVERSITY CONTROL)

Questionnaires were sent by the committee to all Grade A Medical Schools in the United States requesting, in addition to general information concerning the department of obstetrics, data on the type of postgraduate and graduate courses given at each school. Forty-two sent replies; 26 of them reported postgraduate or graduate teaching. Each school was given a schedule number and in the summary this number is used instead of the school.

Questions concerning five types of teaching were listed on the questionnaires: refresher courses, courses for less than one year, courses for one year or longer, courses designed to train specialists, and courses designed to train teachers. In accordance with the definitions of the Committee on Medical Education and Pedagogics only courses of one year or longer given at, or under the direction of, a university would be classed as graduate study. Accordingly, for purposes of this report, refresher courses and courses for less than one year are discussed under the heading of "Postgraduate Education," and those for one year or longer, the training of specialists, and the preparation of teachers are discussed under "Graduate Education." It is difficult to apply any hard and fast rule. Strictly speaking, however, the committee is of the opinion that the distinguishing feature of graduate courses should be research.

REFRESHER COURSES

Eleven schools attested to the fact that they gave Refresher Courses. The educational requirements for admission are similar in that they

all demand that the applicants shall be graduates in medicine. The other conditions imposed do not relate to previous education.

The length of the course varied from one to eight weeks. The number of hours of instruction per week ranged from two to forty-eight. A better idea of the extent of the course may be adduced by giving the total hours of instruction for the schools that furnished figures. The time allotted for the course ran the gamut of eighteen to thirty-six hours for the shortest to two hundred and forty hours for the longest. Naturally, such a wide divergence of time may be ascribed to the varying purpose of the course, the material available, and the scope of the instruction. Any inculcation of knowledge and stimulus aroused which may incite the student to further study is beneficial: the value increases directly as the time and opportunity increase.

All but two of the schools reporting gave courses which included observation and practical work as well as theory. In nine schools the students had work in prenatal clinics and in eight they had work in postnatal clinics. The others either did not report or gave no work in prenatal and postnatal care.

In only three schools were the students permitted to conduct deliveries and in one of these it was elective. In another school they could observe, and one school did not report either way.

It would be desirable for students to have a more definite contact with patients in the pre- and postnatal clinic, and in the delivery room. It naturally follows that a clinic cannot permit, unless there be a most efficient and rigorous control, a student who comes for a few weeks' training to do much of the actual clinical activity: he may be entirely an unknown quantity. Clinical contacts are vitally essential.

Ten of the schools reported on the item of manikin courses; nine of them gave such a course. In five of them it was obligatory, in one it was elective, in two it was not obligatory, and one did not report either way.

The judicious use of the manikin, both as a means of demonstration and for the benefits which accrue to the student when he is required to perform personally all possible obstetric operations, is so important an adjunct to the best teaching of operative obstetrics that it must be most strenuously recommended.

Systematic laboratory work was required in five schools, elective in one, and advised in one. In three schools it was not required.

Ten schools replied to the question, "Are refresher courses useful?" All believed that they were. Three answers respectively were qualified as follows: "to some men," "chiefly as an inspiration to study," "they seem to be of value; of course, they are not to be taken seriously as of educational importance."

The committee feels that the refresher courses are of great value, especially if a part of the course be devoted to manikin demonstration and practice, and some routine laboratory instruction be given.

COURSES LASTING LESS THAN ONE YEAR

The questionnaire brought forth responses from 8 schools which gave protracted obstetric courses.

In 3 schools the course was of six months' duration, in one it was three months, in one it was two weeks and the remainder, 3, did not answer the query. The number of hours per week was stated by only two schools.

On the bare statement of the facts, it would seem a questionable course which has not been planned so that the students will get a maximum of opportunity to fill their time while in attendance upon the course. Such haphazard pedagogy surely must be a waste of time to all concerned. However, the response to the query, "Of what do such courses consist?" removes much of the sting to the critical comment as the assigned tasks provided amply opportunity to the earnest student. Five directors of the courses believed they served a useful purpose; three made no reply.

INTERN YEAR

For some years it has been felt that the clinical instruction during the third and fourth years of undergraduate study is insufficient to complete the student's contact with patients: that it is highly essential that the student shall live a year in the atmosphere of a hospital with all the advantages which will accrue from a rotating service. So, one medical school after the other made the fifth, or clinical year prerequisite for the degree of Doctor of Medicine. At the present time there are 12 medical schools which require five years, and in an additional one this requirement becomes effective in 1933. To conform to the college requirement, the commission on Licensure of the District of Columbia, and the "Licensing Boards" of Alaska, Delaware, Illinois, Iowa, Michigan, New Jersey, North Dakota, Pennsylvania, Rhode Island, South Dakota, Utah, Washington and Wisconsin have incorporated into their regulations that all candidates for licensure shall have had the clinical, intern year. The State of Oklahoma will enforce this requirement in about a year. In view of the progressive requirement in this direction the Committee has held that the "Intern Year" is an undergraduate period, not a graduate course. In most instances the rotating service of the hospital includes a few weeks of duty in the obstetric department, but in most hospitals such service hardly supplies adequate obstetric training.

GRADUATE TEACHING

Graduate teaching covers a longer period than postgraduate instruction. It connotes with the idea that the course is more comprehensive and intensive than the latter. The implication is carried that the

instruction in the course is an approximation of the ideal in that research plays a very important part, and the clinical, practical training is developed beyond the amount allotted to the preparation of practitioners.

In filling in the questionnaire each person naturally followed his own judgment of the way the courses given by his school should be reported, and in some cases, what appears to be the same course was listed under more than one of the classifications on the questionnaire, and in others it was listed under only one.

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Educational Requirements and Years Required for the Course.—The evaluation of the data available on these items is illuminating. The replies depict the reactions to individual ideals, opportunities available, and possibly to the available supply of clinical material and equipment. Experience is the power to assimilate knowledge derived from clinical opportunity based upon sound precept and example. The wide divergence from one to ten years is explained undoubtedly on the score of the intent of the course—to make a man a good practitioner on the one hand or an expert on the other.

Hours of Instruction per Week.—The results of this query are not illustrative of the amount of work required, and the amount of teaching given to the students (residents). A large obstetric and gynecologic clinic puts many demands upon the residents during the many hours consumed in attending patients, in the dispensary, wards and operating rooms. All this is distinctly educational, especially during the early part of the course, when their activities are carried on under supervision, and really continues when they assume full charge of their work. Too, it would be manifestly impossible to evaluate the time consumed in routine laboratory duties, and later, in research.

Answers to the questions on whether the student lives in the hospital and the nature of his work need no explanation. All of the schools in this group control their affiliated hospitals at least so far as staff appointments are concerned.

It will be noted that only 4 of 10 schools that definitely answered the question, "Is any university recognition given for the course?" replied in the affirmative.

It is truly an anomalous situation which confronts us in that Universities give courses which lead to a high order of technical training, producing specialists, and yet do not offer any recognition for the task accomplished. There is no other place in university activity where a comparable state of neglect is manifested. Can we wonder that the terms "specialist" and "professor" are so meaningless as they are in these United States?

How Many Years of Training Are Required to Make a Specialist?—
There were 19 institutions which gave more or less data concerning
this question.

Thirteen schools reported on the number of men they had been able
to train as specialists, the number ranging from 1 to "approaching 50"
and making altogether a total of 147. Six schools made no report on
this item.

The Committee sincerely believes that the men who have had the
advantages of this training have been so developed in the science and
art of obstetrics that they are truly leaders of the specialty. They
have spent arduous years in preparing themselves for their profes-
sional duties. Not a few men have sought centers where they might
secure a reasonable training in obstetrics, either here or abroad: how
inadequately they have been trained is a conjecture, or how perfectly
they have been equipped cannot be determined. The parody of it is
that the term obstetric specialist is meaningless in this country. That
this opprobrium is more significant of obstetrics than other special
fields is doubtful. It is manifestly easy for the poorly equipped man
to get away with the rank and file of obstetric work: the majority of
cases require little need for operative intervention, so the self-styled
obstetrician has little opportunity of developing skill and dexterity
in the operating field. Obstetric experience comes not from the at-
tendance upon a maximum of normal labors. True knowledge, skill
and experience come only from the care of a large series of compli-
cations in pregnancy, labor and the puerperium.

The medical directory for one of our large cities contains the names
of 411 and 440 physicians respectively who are carried in the classi-
fied lists as obstetricians and gynecologists: it would be a waste of
time to ascertain how many names were duplicated in the lists. Can
we wonder that there is the insistent cry for better obstetrics? Is it
a wonder that we are confronted with the statement, bandied from
one end of the world to the other, that the great United States has
almost the highest maternal mortality of the world? Obstetrics needs
improvement.

TRAINING FOR IMMEDIATE PROFESSORSHIPS

Only eight schools have definitely provided such training, one has
"just started" and another "hopes to." Only four report placing
men as professors in Class A medical schools, the number so placed
being 20. The remainder either had placed no men or did not reply
to the question on this point.

There are more than a thousand physicians who are actively en-
gaged in the teaching of obstetrics and gynecology in the United
States. This number includes men of all ranks who are listed in the

medical school catalogs. It is evident from the Committee's survey that the facilities in medical schools for training teachers are not yet adequate, and that most of the men occupying teaching positions have developed through their own efforts, often without the supervision and training of able clinicians, teachers and investigators. Among the group of self-taught men are not a few who, inspired by altruistic motives, have developed themselves into teachers of the highest type. They are the men who have been the pioneers in blazing the way toward the modern conception of what obstetric-gynecologic teaching and practice should be. They graduated from medical school poorly prepared and, inspired by high ideals, developed themselves into great clinicians and teachers.

A number of the Heads of Departments, who replied to the Committee's questionnaire, outlined their own training. Most of them have received their special training in obstetrics by serving as assistant residents, residents, house physicians, instructors and so on up the line until they were finally made full professors. Several have had graduate work in Europe. There are undoubtedly many others in the teaching group who have gone abroad for graduate study. Surely there is an obligation on the part of American medical schools to provide opportunities for graduate work which would make travel to a foreign country for this purpose at least a matter of choice rather than a necessity.

Division of Teaching Faculties.—A study of the faculties of the departments of obstetrics and gynecology as listed in the catalogs of 62 of the 65 Class A medical schools giving four-year courses showed a total of 1045 faculty members. Three hundred and ninety-six taught obstetrics, 343 taught gynecology and 306 taught both obstetrics and gynecology.

For years past many of the European schools have had their professors developed as teachers, clinicians and investigators in both obstetrics and gynecology. The two fields closely interdigitate so that it is impossible to divorce knowledge in one field from that in the other. The present trend in the medical schools of this country is toward the combination of obstetrics and gynecology in a single department as is evidenced by the opinions expressed by the Deans of Medical Schools who replied to the committee's questionnaire on undergraduate teaching. Of 57 who replied to the questionnaire 42 were in favor of a unified department.[1] However, this is relatively a recent development in this country and this accounts in part at least for the division of the faculties into three groups of which over one-third teach obstetrics only, approximately one-third teach gynecology only, and less than one-third teach both obstetrics and gynecology. Presumably those who teach in only one field do not consider themselves,

[1]See report on *Undergraduate Teaching*, p. 786.

or are not considered by others, to be competent to teach both branches. Such a situation will undoubtedly be rectified as more and more of the medical schools make their separate departments of obstetrics and gynecology into a combined department. At present in some of the outstanding schools of the country a man may secure graduate training in one or the other field; often it is difficult for him to secure training in both. Fundamental training in both fields gives a better background for future work even though one subsequently does intensive work in a limited field. No one can cover all phases of both fields with equal thoroughness. However the teacher should be sufficiently familiar with all the more important phases to impart information and direct investigation. It is probable that the next few decades will mark a distinct advance in graduate teaching in obstetrics which will be due largely to more competent instruction associated with the development of unified departments.

GENERAL INFORMATION CONCERNING THE SCHOOLS THAT REPORTED ON POSTGRADUATE AND GRADUATE COURSES

Certain general information concerning the 26 schools which reported that they gave one or more types of postgraduate or graduate courses will undoubtedly be of interest.

Hospital Facilities.—Twenty-two schools control the obstetric and gynecologic services in their affiliated hospitals; 1 reported that it controlled the obstetric service, but made no report on the gynecologic service, and three did not reply to the question on this item. In 15 of the schools and 14 of the hospitals the departments of obstetrics and gynecology are combined. It is probable that one or more of the three schools which did not report on their hospital facilities also have combined departments.

When surgical cleanliness was introduced, in 1880, there was some evident reason why obstetrics and gynecology should have been separated. Gynecology sprang into being as a great specialty—few were trained to perform the tasks which were possible—large fees were commanded. The mundane obstetrics, commonly called midwifery, of that day, was not attractive, the tedious hours of attendance on the confinement, with ridiculously small fees, were not inviting to the men whose prestige commanded large fees. Most obstetricians in the period to 1900 were entirely incompetent to perform any obstetric operations which required surgical technic, so, perforce, the general surgeon or the gynecologist did the few cesareans which were done. During these years, the obstetrician occupied a menial place, entirely unenviable, in the medical school and hospital—and withal, received scant respect from the public at large. With the beginning of the twentieth century the surgical era of obstetrics began. The obstetrician began to come into his own: as his prestige waxed strong, and

he began to develop his knowledge and skill in abdominal surgery, he was increasingly able to cope with the serious obstetric complications which required abdominal operative intervention. In fact, wherever the obstetrician became a skilled abdominal operator, there the mortality of cesareans diminished; the man who knew all the obstetric complications, knew the indications and contraindications for an operation, knew when that operation should be performed, was infinitely safer an operator than the general surgeon and gynecologist who knew next to nothing of obstetrics. Obstetrics and gynecology are fundamentally one and indivisible. In fact, the vast majority of maladies and injuries peculiar to women which bring the women to the operating table are merely delayed manifestations of the mishaps of childbearing. These more properly belong to the skilled obstetric surgeon than to any other operator: remove all of these conditions from the field of gynecology and the gynecologist essentially would be restricted to neoplasms and Neisserian infections. Good obstetrics will diminish the need of gynecology as time goes on. The combination of obstetrics and gynecology into a dual department for administrative, or other, reasons is specious, and usually results in the appointment of a head who is either interested in one field or the other. The results are hardly comparable to conditions when the departments are distinctly separated, each controlled by a man who has an avid interest in this restricted field. The Committee firmly believes that the two should be unified as a pedagogic and clinic entity, a man who is not regularly performing major abdominal operations is not a finished obstetrician; the patient, the student, and the obstetrician himself demands that unification should be the rule.

It has been stated that fully one-quarter of the general practitioner's income is derived from obstetrics, and a like proportion of his professional time is devoted to the same field. This is not far from correct: in view of this it would seem that in some of the schools obstetrics did not have the quota of beds desirable for its pedagogic needs. That students of medicine may receive adequate clinic opportunity in obstetrics there should be, under the most conservative estimate, at least one teaching maternity bed for each student enrolled in the class; each bed will approximately supply the needs of 26 or 30 confinements annually. For the undergraduate instruction there should be a maximum of normal labors, without an undue disproportion of pathologic material, although the student should be able to see all phases of the pathology of the childbearing woman. On the other hand, the graduate student should have a great opportunity for witnessing and, under proper supervision, operating on complicated labor cases. An intimate knowledge of all the normal phenomena of the parturient state is the foundation for obstetric practice; only by an extensive and varied experience with pathologic material may the

student equip himself as a truly trained obstetric specialist. The ideal maternity for the graduate student is one which has a constant influx of complicated cases, brought in by the police ambulances or other agencies: "neglected cases" offer invaluable experience to the graduate student.

Teaching Facilities.—The personnel in 13 schools were on a part-time basis, in 5 schools they were on a full-time schedule, in 4 schools part of the personnel were on part time, others on full time, 1 school said "neither full nor part time" and 3 did not answer. In 10 schools it was felt the personnel was adequately compensated, in 11 schools it was believed the pay was insufficient, one said that not enough of the staff were well paid, in one school teachers received no pay, and 3 schools made no reply.

In response to the question, "Are the teachers required to conduct and direct research studies?" 11 replied in the affirmative, 9 stated it was not required, one said this was gradually being required and 5 made no reply.

Laboratories.—A survey made by the Committee showed that some 75 per cent of the schools that made definite replies are equipped to take care of routine laboratory work; whether these laboratories are departmental divisions or are an integral part of the service is relatively immaterial, though it would be desirable for the department to have its own laboratory technicians, equipment, etc., all houses contiguous to the wards. As to research, the equipment is sufficient for adequate investigation in approximately 60 per cent of the schools that made definite replies. There is an increasing conviction that each department of the college and hospital should have its own laboratory for routine study and research. The principles of the basic sciences may better be inculcated into the minds of students, undergraduate and graduate, if the laboratory findings are directly "hooked up" with clinical manifestations and this only may most happily be realized when the department has its own laboratory facilities so all the department personnel may have ready access for the study of their individual problems.

Budgets.—The question was asked if the budget was adequate for materials, technicians, and servants. The answer was favorable in 15, 12, and 10 respectively; an unfavorable reply was made in 7, 10, and 9 respectively, and one said "partially" adequate for servants. The remainder did not reply.

Type of School.—In response to the question "Is your school a University Institute or a Trade School?" the professors of 11 schools certified to the fact they had an "Institute," and 3 that they had a "Trade School." Strangely enough, two of the teachers in the latter group are members of faculties of strong medical schools. There was no reply from 9 schools and the remainder gave some indefinite an-

swer such as "neither," "not a trade school," "not a trade school nor an ideal university institute."

Library Facilities.—Library facilities were available in 22 schools; absent in 1; and 3 failed to answer.

COMPLETENESS OF THE REPORT

The foregoing summary is made up from questionnaires received from 42 of the 65 Class A medical schools in the United States which give four-year courses. No questionnaires were received from 23 of the Class A schools. However, only one of these schools is listed by the Council on Medical Education and Hospitals of the American Medical Association as giving graduate courses in obstetrics. Although not all of the schools that are doing graduate teaching in obstetrics are included in this list, failure of the schools to return a questionnaire coupled with their omission from this list by the council would seem to indicate that little if any graduate teaching in obstetrics is done by them.

The report does not include information on the courses in obstetrics given by one graduate medical school which is on the list of graduate medical schools approved by the council.

These two schools are the only known omissions from the report.

RECOMMENDATIONS

1. More teaching institutions should endeavor to provide adequate graduate courses in obstetrics.

2. While this Committee believes the fifth, or intern year of medicine to be an essential part of undergraduate education it must be remembered that the great majority of medical schools and state licensing boards do not so recognize it and until they do, adequate provision should be made to provide postgraduate and graduate courses in obstetrics for those graduates who have not had the educational opportunity offered by the intern year.

3. The European plan of the "Frauenklinik" which has been initiated in this country should be extended to all medical schools. Gynecology should be confined to a place subordinate to obstetrics.

4. Each university medical school should have its own maternity hospital sufficient to meet the undergraduate and the graduate re-requirements if such schools undertake to do graduate teaching. Schools with maternity hospitals located in metropolitan areas where they have a large amount of pathologic material are best suited for graduate education in obstetrics.

5. Certain fundamentals should be an integral part of each type of postgraduate and graduate teaching. The Committee recognized the importance of having in all medical schools strong departments for the clinical branches. The departments of the basic sciences assume

especial importance in a medical school which undertakes to give graduate instruction for the purpose of training competent specialists, teachers, or investigators in the field of obstetrics.

6. The modern teacher should be well trained in operative technic as well as in all other clinical fields. It is desirable that he be a trained investigator.

7. Hospitals which are not closely associated with educational institutions are not suitable places for true graduate education but with the proper development of a teaching staff they would fulfill a very important place by giving postgraduate instruction designed to train men for special practice.

8. Graduate schools should have comparable methods of describing their courses which would give the prospective candidate a clear idea of the nature and length of the course and the credits given.

9. Schools giving graduate courses should adopt common minimum standards. This would not prevent any school from offering a more highly developed course.

10. In graduate education a candidate should fulfill certain fundamental requirements which would be a measure of his ability before being recognized as a specialist, a teacher, or an investigator, and before being given a degree. "Hours" have no significance in graduate teaching.

11. State universities should develop courses of the circuit type for the purpose of improving and keeping local practitioners up to date.

12. Steps should be taken by the medical profession to the end that only properly qualified physicians may designate themselves as obstetric specialists capable of deciding upon and performing major obstetric procedures. There should be some ethical relationship between practitioners and specialists which would enable them to work together to serve the best interests of the patient.

13. No hospital should permit other than a well-qualified obstetric specialist to attend a serious obstetric complication or perform a major obstetric operation without consultation with a well-qualified specialist, preferably one attached to the hospital staff.

14. All interested organizations should endeavor to stimulate improvements in obstetric teaching and practice.

CONCLUSIONS

1. It is well recognized that the vast majority of gynecologic practice is concerned with the correction of belated ill consequences of childbearing. The gynecologist who is not in intimate contact with all phases of obstetrics has lost much of his perspective in operating on women of the childbearing period. The obstetrician who does not do the surgery of the lower abdomen is hardly competent to do the major abdominal work of obstetrics.

2. Adequate graduate as well as undergraduate education in obstetrics is necessary to provide skilled obstetric and gynecologic care to women and to prevent the ill consequences of childbearing. The first step required is the complete unification of departments of obstetrics and gynecology in teaching institutions.

3. A unified department demands that all the personnel shall teach and practice both the immediate and the remote care of the childbearing woman and shall teach both branches.

4. Improvements in obstetric practice will come only from improvements in undergraduate and graduate education in obstetrics. This should result in a decrease in the number of maternal and early infant deaths and a reduction in the complications which contribute to or cause conditions necessitating operative procedures later.

5. Postgraduate and graduate courses in obstetrics have not been developed in the United States to the extent necessary to meet the need and demand for such teaching.

6. Only 19 of the schools replying to the Committee's questionnaire report that they give courses designed to train men as obstetric specialists. Thirteen of these schools report that they have trained 147 men. Obviously many of the men practicing as obstetric specialists have gained their experience through practice rather than formal graduate training. The term "obstetric specialist" as used in this country does not always indicate special preparation or qualifications in this field. A new and better plan should provide that no man be designated as an "obstetric specialist" until he has proved his ability to so function.

7. Only ten of the schools replying to the Committee's questionnaire report that they give courses designed to train men for holding professorships in Class A medical schools. There are more than 1,000 physicians engaged in teaching obstetrics and gynecology in the United States. Many of them have developed themselves after a more or less insufficient undergraduate training.

8. Work done in a number of states has demonstrated that circuit or extension courses are a valuable means of bringing inspiration and knowledge to physicians who are distant from or unable to attend resident courses in the large medical centers. These courses should be practical and bring only tried and true facts to physicians; fads should not be tolerated.

9. The plans inaugurated by the Chicago Medical Society, and the Kansas City Southwest Clinical Society and others appear to offer another practical method of supplying postgraduate instruction in obstetrics and to be worthy of emulation by other societies.

OBSTETRIC TRAINING OF NURSES AND ATTENDANTS*

By George W. Kosmak, M.D., New York, N. Y.

THIS Committee, in an attempt to learn how nurses are being prepared for obstetric nursing today and what they really know about maternity care, has made a study of:

1. The nurse's knowledge about obstetric nursing in 1930.
2. The state regulations governing hospital schools of nursing where obstetric nursing is taught, including the curricula for that teaching.
3. Some of the actual conditions in 1930 in a number of the schools of nursing where obstetric nursing is taught.
4. Some of the opportunities for postgraduate work in obstetric nursing.
5. The trained attendant in maternity care.

This report therefore includes five sections, each covering one of these five points, followed by a summary of the recommendations and a conclusion.

I. THE NURSE'S KNOWLEDGE OF OBSTETRIC NURSING IN 1930

Before studying the education of nurses for obstetric nursing, it is well to have a present-day picture of what nurses are called upon to do in this field, and of just how much they really know about maternity care.

Maternity care should be the same the world over. Whether the mother lives in the city or the country, in a palace or in a hut, she needs medical and nursing supervision, care, and instruction during pregnancy; an aseptic delivery under the direction of a skilled obstetrician; and medical and nursing supervision, care and instruction until after she is able to resume her regular responsibilities and to care for her baby. Physical surroundings and the attitude of mind of the patient and her family may differ, but the actual care of the mother should be the same.

What part the nurse will take in this supervision, care, and instruction of patients, will differ in different communities. Just what it will be in any given instance will depend on the available medical and nursing facilities and on the division of labor between the doctor and the nurse. Of course, certain parts of the care must be given by the doctor and under no circumstances can these be delegated to the nurse, no matter how complete is her knowledge of obstetric nursing or even of midwifery.

* * * *

To learn how much nurses really know, today, about maternity care, this committee submitted two questions to three groups of nurses.

The questions, chosen because they were comprehensive and avoided controversial differences of opinion about obstetric procedures, were:

1. State what you consider constitutes complete care for a mother from the beginning of pregnancy until the baby is six weeks old.

2. How can maternal mortality be prevented? The groups of nurses selected were:

1. Private duty nurses registered in 1930 for obstetric nursing in the 93 Nurses Official Registeries. Each registrar was asked to send the names of ten nurses to whom the questions could be submitted.

2. Nurses graduating from schools of nursing in 1930 and taking the State Board examinations in the summer months. Each Board of Examiners was asked to present the questions to its applicants, with the request that they be answered, not for credit, but as a contribution to the work of President Hoover's Conference.

3. Nurses taking postgraduate courses in public health nursing in 9 universities in 9 states, and writing examinations in the summer of 1930. The directors of the courses presented the questions as supplementary to their examinations in much the same way as the state boards of examiners did to the second group.

The first group includes nurses who had their formal education in obstetric nursing few or many years ago and have added to that education, more or less experience in obstetric nursing.

The second group includes the nurses who have just completed their formal education in obstetric nursing and at the same time, represents the majority of nurses doing obstetric nursing in the hospitals, since most of that work is done by student nurses.

The third group includes nurses who had their formal education in obstetric nursing few or many years ago. They have had, too, a certain amount of experience in obstetric nursing and that staff education which is given by most public health nursing organizations. Obviously they have more than average interest in improving their equipment as evidenced by their enrollment in the public health nursing courses. Furthermore they have had also whatever obstetric nursing instruction is included in the theory and practice of the present postgraduate courses in public health nursing.

In all 1,622 nurses returned the answers to these questions. This is, of course, only a sampling of the nurses doing the obstetric nursing throughout the country in 1930 but it can be considered representative of the whole number.

Significant Findings.—The answers to the question about what constitutes complete maternity care, contained no comprehensive statement of maternity care as a continuous medical and nursing service to mothers from the beginning of pregnancy through the puerperium. The nurses answered the question by listing the various items in the

detail of that care and supervision. The lists were incomplete in almost every instance.

There seems to be no escape from the conclusion that nurses do not know what adequate maternity care is when, out of 1622 nurses, 17.9 per cent mention, as an essential element of that care, a physical examination followed by continuous medical supervision during pregnancy, 8.4 per cent mention pelvimetry, 23.7 per cent mention blood pressure, 66.5 per cent include any one of the elements of good personal hygiene, 24.9 per cent mention an aseptic delivery, 8.7 per cent postpartum medical care and only 5 per cent postpartum nursing. One wonders if the answers would have been any better if the question had asked for the details of some nursing procedures. It seems hardly probable when these answers reveal so little understanding of the value and significance of the individual procedures in the whole service.

The question about preventing maternal mortality was not answered at all by a discouragingly large proportion of the nurses. Very few of them answered it in a way to indicate that they had any real knowledge of the causes of maternal mortality or of the means for reducing it. A number answered it in a way that showed they had no idea what the question meant. The answers included such statements as "maternal mortality should not be prevented," "by belief in God," "it is now so low that nothing more can be done about it," "oh, dear, I don't know," "by better obstetrics," "by enforcing the Volstead Act," "by birth control," and "by the above care," meaning the incomplete care that was outlined in the answer to the first question.

And so we must conclude that, with few exceptions, nurses do not know that many of the deaths of mothers in childbirth can be prevented, that obstetric nursing plays a part in that prevention or that the great number of those deaths in this country is a national problem that challenges every doctor, nurse and health worker who comes in contact with pregnant mothers.

It is significant that the nurses taking the postgraduate courses in public health nursing answered the questions better than the other two groups and that the private duty nurses did better than the new graduates. The best answers came from the students in a postgraduate course in public health nursing who had recently attended an institute in obstetric nursing.

Examination questions at best are only one means of testing knowledge, but if we cannot expect nurses to be able to explain the care pregnant mothers need and why they need it, our task of teaching the public is even greater than we thought it. Furthermore what the nurse says does influence many patients and their friends and what can be worse than influence based on ignorance of the fundamental essentials of good maternity care? Truly this is one time when "a

little knowledge is a dangerous thing." Perhaps our method of in-
cluding obstetric nursing in the fundamental education of all nurses
is not so effective as that of requiring postgraduate courses for those
who will do obstetric nursing. Perhaps it is the emphasis of our
teaching that is at fault. Perhaps we emphasize the "how" of our
individual hospital routines at the expense of the "why" that helps
the nurses to think and gives them a broader understanding. Perhaps
it is the amount of our teaching and experience that is inadequate.
The next three sections of this report are devoted to an analysis of the
teaching of obstetric nursing.

The Committee therefore recommended: That this apparent lack
of knowledge about maternity care among nurses doing obstetric
nursing be called to the attention of state and national nurse associa-
tions, state and local departments of health and organizations con-
cerned with the prevention of maternal mortality and that they be
urged to conduct institutes or other refresher courses for all nurses
doing obstetric nursing.

II. STATE REGULATIONS GOVERNING THE HOSPITAL SCHOOLS OF NURSING
WHERE OBSTETRIC NURSING IS TAUGHT

Committee Procedure.—This committee examined the state laws and
board rulings of 43 states and the District of Columbia. While not
complete, this number gives a fair picture of the whole.

The requirement in these 44 states for volume of work as determined
by the size of the hospital varies from 20 to 50 beds with a daily oc-
cupancy of from 15 to 50 patients.

In 11 of the 44 states the requirements do not specify either the
theoretical instruction or the practical experience of the curriculum
for teaching obstetric nursing. In 26 of the other 33 states the re-
quirements specify the number of hours of theoretical instruction in
obstetric nursing varying from ten to forty-five with the majority
requiring sixteen hours. In 8 of the 33 the requirements specify the
use of the League Curriculum. In 2 of the 33 states curricula have
been prepared by the Boards of Nurse Examiners of those states. In
the other 23 there are no specifications about the content of the in-
struction in obstetric nursing except that 7 of them require Lectures
and Demonstrations.

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In 28 of the 33 states, the requirements specify either the time to
be spent in practical experience in the obstetric department, or the
number of obstetric cases each nurse must have, or both. The time
is usually three months but the number of cases varies from 5 to 20,
the majority being 10 or 12. The number of cases seems to mean the
number of deliveries at which the nurse must assist and usually im-
plies a related amount of postpartum and postnatal experience. In
only 2 states is there any mention, and neither is a requirement, of

correlating the hospital instruction and experience with actual super-vised work in the homes of patients.

* * * *

This comparison of the *state regulations* affecting the teaching of obstetrics with a statement of the *necessary fundamentals* possible of acceptance by the majority of schools of good standing shows:

1. Hospitals with too few patients to offer adequate variety and volume of service are accredited as schools of nursing in most states.

2. The educational prerequisite required for admission to schools of nursing is too low in most states to assure students capable of making the most of good instruction in obstetric nursing.

3. The length of the course in nursing required is adequate in the majority of states.

4. The theoretical instruction in obstetric nursing required, is inad-equate in most of the states where it is specified while in about one-fourth of the states there is no attempt to specify the amount of instruction.

5. The amount of time for practical experience in obstetric nursing required in the majority of states where it is specified, is equal to that considered necessary by the League Curriculum for elementary instruction in obstetric nursing if properly spent in the different parts of the obstetric department and if adequately supervised.

6. There is no requirement in most of the states for experience in the care of normal pregnant mothers before delivery or in the care of patients in labor or postpartum patients outside the hospital.

7. There is no requirement about the qualifications of teachers and supervisors.

The Committee recommended: I. That since laws and regulations usually follow rather than lead public opinion and practice, no direct effort be made at this time to improve the state regulations affecting the teaching of obstetric nursing; but that enthusiastic support be given to every improvement proposed by the State Boards of Nurse Examiners.

II. That an effort be made to acquaint the public particularly or-ganized groups like Chambers of Commerce, Rotary Clubs, Federated Women's Clubs, etc., with the community's need for nurses who know obstetric nursing to help in the maternity care that will reduce our high maternal mortality, and to urge them to support every move to increase the state requirements for their preparation to do that work.

III. SOME OF THE ACTUAL CONDITIONS IN 1930 IN A NUMBER OF THE SCHOOLS OF NURSING WHERE OBSTETRIC NURSING IS TAUGHT

State regulations present the minimum requirements for schools of nursing, not necessarily the conditions in the majority of schools. Some of the important conditions affecting the teaching of obstetric nursing are not touched upon in the state regulations.

Committee Procedure: The Committee prepared a questionnaire covering some of the conditions affecting the teaching of obstetric nursing and sent it to the Directors of Nursing in 593 hospital schools, in order to learn what these conditions are today.

Questionnaires were returned by 316 schools, of which 300 were in general hospitals and 16 in special maternity hospitals. Not all questions were answered on every questionnaire. This provides a sampling of the schools in hospitals of the maximum bed capacity required by the state regulations, and represents all the states.

Significant Findings: The Committee learned from the List of Accredited Schools that in January, 1928:

Sixty-five per cent of schools teaching obstetric nursing are in hospitals having a daily occupancy of 50 or more patients, the maximum required by any state regulation.

Thirty-one per cent of them in hospitals having 100 or more, the number suggested as necessary in the League Curriculum.

Sixty-seven and four-tenths per cent required more than one year of high school as a prerequisite. The majority of states require one year.

Thirty-one and nine-tenths per cent required full high school which the League Curriculum considers necessary.

Eighty-seven and five-tenths per cent of the schools teaching obstetric nursing gave a course in nursing of three or more years.

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The consideration of present conditions shows:

That 35 per cent of the schools teaching obstetric nursing are in hospitals with a daily occupancy less than the maximum required in any state regulation and only 31 per cent have a daily occupancy equal to that considered necessary by the League Curriculum, while only 31.9 per cent have the educational prerequisite considered necessary by the League Curriculum.

With poorly prepared instructors and supervisors and with students doing all the nursing and therefore not always free to take advantage of opportunities to learn, it is fair to say that a service of less than 10 obstetric patients a day does not offer a sufficient volume and variety of experience for teaching obstetric nursing. Yet 50 per cent of the hospitals teaching obstetric nursing and answering this questionnaire offer less than that, and do not include antepartum or postpartum clinics.

The Committee recommended: I. That these conditions affecting unfavorably the teaching of obstetric nursing and the apparent ignorance among nurses doing obstetric nursing, be discussed with the Executive Secretary of the National League of Nursing Education and a plan made for calling the situation to the attention of Hospital Trustees, Medical Boards, Superintendents, and Directors of

Nursing, with a formal request from the White House Conference that they arrange to give nurses a better preparation for helping in maternity care.

a. By improving obstetric service in accordance with the standards of maternity care published by the Children's Welfare Federation in 1930.

b. By using graduate nurses and attendants, not student nurses, where the volume of service and facilities for teaching are inadequate.

c. By improving, by a program of staff education, the qualifications of the nurses now teaching and supervising in the obstetric department.

d. By employing graduate nurses to do some of the nursing, so the students may be freer to make the most of learning.

e. By making the prerequisite for admission to the school, four years of high school.

f. By planning for all students as soon as possible, practical experience which shall include antepartum and postpartum clinics (with home follow-up as assistant to the prenatal or social service nurse), general nursing care of bed patients in maternity wards, of babies in nurseries, of at least 20 patients in labor and during delivery, delivering one or more patients under supervision, work in an out-patient department or visiting nurse association doing prenatal, delivery, and postpartum work under good supervision so the students can learn to adapt teaching to home conditions while still being taught.

g. By giving the theoretical instruction outlined in the League Curriculum.

IV. SOME OF THE OPPORTUNITIES FOR POSTGRADUATE WORK IN OBSTETRIC NURSING

Committee Procedure: The Committee included a query about postgraduate work in obstetric nursing in the questionnaire sent to the 593 hospitals.

Significant Findings: Of the 316 schools returning the questionnaire, 36 offered postgraduate work in obstetric nursing. These courses are practically the same in content as the undergraduate, and, in most instances, they were established for the same purpose, namely, to secure nursing service for the hospital. The experience of the postgraduate students is not arranged for its educational value any more than is that of the undergraduates. The instructors and supervisors are those found in the 316 schools described in the third section of this report. These courses do not meet the requirement of a true postgraduate course for advanced study and experience built on a known prerequisite of theoretical instruction and practical experience in the same field. They do give nurses an opportunity to learn something about obstetric procedures as they are carried out in different hospitals and directed by different obstetricians. In this way

they do offer additional experience and may also serve as a means of keeping graduate nurses in touch with changes and developments. They do not, as now organized, offer adequate educational facilities for the preparation of experts except as nurses with superior educational background can capitalize the experience by self-directed study.

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The Committee recommended: I. That Hospital Trustees, Medical Boards, Superintendents and Directors of Nursing be urged to accept as students those graduate nurses who wish to make up for the deficiencies in their elementary instruction in obstetric nursing or to keep informed of changes and developments in obstetric procedures.

II. That a suitable Committee be asked to consider also the preparation of a curriculum for a true postgraduate course in obstetric nursing and of a plan for securing at least one such course.

V. THE TRAINED ATTENDANT IN MATERNITY CARE

In addition to registered graduate nurses who are known to have had at least a specified minimum of education for obstetric nursing, there are many trained attendants from registered or nonregistered schools as well as many women, with no formal preparation but with varying amounts of experience and skill, giving an unknown kind of nursing care to maternity patients. The number of these women, known generally as practical nurses, who are employed, seems to indicate a need for an attendant who will stay in the home of the maternity patient and will do housework as well as nursing. Only a small part of the whole number of maternity patients is cared for in hospitals where the selection and supervision of nurses and aids or attendants is comparatively easy to control.

The registration of schools for trained attendants, the licensing of their graduates and some form of supervision for these attendants seems to be necessary for the protection of patients and doctors.

The Committee learned from the State Boards of Nurse Examiners, that in four states the schools for trained attendants are registered and that there are fourteen such schools. Questionnaires were sent to all these schools and were returned by nine of the fourteen. These questionnaires showed that none of these schools gives a sufficient training in maternity care to qualify their graduates to care for maternity patients.

There are a considerable, but impossible to determine, number of maternity, and other special hospitals, conducting nonregistered schools for trained attendants. Their graduates are probably well trained though there can be no assurance that even a minimum standard of instruction is followed because there is no check on schools that are not registered. Many of these nonregistered schools have undoubtedly dropped their state registration because the state requirements for the registration of schools for trained attendants did not

take into consideration the maternity attendant but were framed with thought for the attendant for the care of chronic illness or of mental patients. Further study of the use of attendants would seem to be necessary in order to shape a minimum standard of requirements for their training schools. Untrained and unlicensed attendants or practical nurses do a great deal of maternity work of an unknown quality. Trained in registered schools, licensed and supervised they can do a great deal of valuable work to supplement the work of the doctor and the nurse in any community program for adequate maternity care.

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The Committee recommended: I. That a special committee be formed to study the best way to prepare, control, employ, and supervise attendants for maternity work.

This Committee to include in its membership, obstetricians, public health nurses and nurse registrars who have worked with attendants, nurse superintendents of schools for trained attendants, and representatives from Boards of Nurse Examiners in one or more of the states registering schools for attendants, laymen interested in the community nursing service, and educators.

CONCLUSION

The hasty study that it has been possible for this committee to make, of the teaching of obstetric nursing, has shown that teaching to be inadequate and to be affected by the conditions in the schools of nursing which have assumed or accepted the responsibility for the teaching of obstetric nursing as part of the fundamental education for nursing.

Improvement in the teaching of obstetric nursing is dependent either on correcting the conditions affecting it unfavorably in the schools of nursing or on devising some means for teaching obstetric nursing to large numbers of graduate nurses as a postgraduate subject before they are permitted to care for maternity patients. Both possibilities involve work by a Committee especially interested in maternity care and qualified to develop methods for, and to stimulate the adoption of, better teaching of obstetric nursing. Such a Committee would need funds and a full-time secretary who should be a nurse who knows obstetric nursing. Such a Committee should work closely with the National League of Nursing Education and the Committee on the Grading of Schools of Nursing to avoid duplication of effort.

It will be some time before the work of such a Committee can be finished. In the meantime those improvements that can be stimulated by an appeal from the White House Conference to all Hospital Trustees, Medical Boards, Superintendents, Directors of Nursing, Boards of Nurse Examiners and nurses associations should be encouraged.

THE EDUCATION OF MIDWIVES*

By James R. McCord, M.D., Atlanta, Ga.

INASMUCH as one of the most important factors in the health and protection of the child is the survival of its mother at childbirth, and as survival of the mother is in turn affected by the type of care she receives at childbirth, a complete program of child care must take into consideration not only the obstetric education of the physician, who, in this country, attends approximately 85 per cent of the births, but also the midwife who attends a large part of the remaining 15 per cent.

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It is not possible to include in this brief survey a detailed account of the development of regulations and midwife education, country by country. In general it is known that such rules governing midwives as existed in Europe before the nineteenth century had legal and religious aspects rather than medical. In Denmark the first midwife commission was established by law in 1714 and in the same year an examination for midwives was provided by law, but a system of instruction for midwives was not started until 1787. Gradually the need for state regulation concerning education and practice came to be recognized, and during the nineteenth century regulations were put into effect in all countries of Europe except England, the latter not enacting such legislation until 1902. Today all countries of Europe have standards for midwife education, either national or provincial. In Germany, for example, each state has its own laws, and the same applies to the cantons of Switzerland. Some countries have both state and private schools, others have state schools only, and in others all schools must be approved by the state. A midwife must complete a course of training varying from six months to three years. In France, final examinations must be given only by the medical department of a university. In Denmark where the instruction is carried on as part of the maternity-hospital service, the midwives are taught by doctors, nurses, and midwives, and the teaching is under the direct supervision of two professors of obstetrics from the State Medical School. For the most part, in European countries midwives are taught and permitted by law to attend only normal cases of delivery, but there are exceptions to this. In Sweden, with a scattered rural population, it is recognized that a midwife must be capable of acting in emergencies, and she is taught to perform certain obstetric operations such as manual removal of the placenta, external, internal and combined version,

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extraction in breech presentation and the use of low forceps. In Denmark, in addition to the care of normal confinement, a midwife may act on her own responsibility in a number of complications, including extraction of breech presentation in a multipara, version of the second twin if it lies in transverse presentation, suturing of lesser ruptures of perineum and use of ergot for lesser postpartum hemorrhage. In both Denmark and Sweden midwives attend more than 85 per cent of the births.

The public control of midwives in Europe is by regulations pertaining to licenses, birth and other reports, records of work, disease notification, requirements for calling in a physician in complicated cases or emergencies, punishment for malpractice or violation of the regulations, and in some places by supervisory visits. There is no provision for inspection of midwives' patients by physicians, except in cases of complications following delivery.

In most countries of Europe the midwife in training pays a tuition fee for her course of instruction, but frequently this fee is very small. In Austria free training is provided and in Holland a certain number are given free training in return for their practicing in scattered country districts at a fixed salary.

In order to insure the services of a trained midwife in communities where the number of confinements is so small that the fees from private practice would not yield a living wage and also to provide services for indigents, some countries have adopted the plan of supplementing the midwife's income by a grant or salary from public funds.

This brief summary will serve to point out some of the main points in the history and present status of the midwife in Europe. Now let us turn our attention to this country.

The first permanent settlement in America was made in 1607, just seventeen years after the death of Paré and but a few more years after the establishment of the first school for midwives in Paris. As would be expected, in America under the primitive conditions of colonial days, midwifery did not receive the attention that it was receiving abroad. Women in the colonies were assisted in childbirth by midwives, if they were available, or by women friends. It may be of interest to know that the wife of Dr. Samuel Fuller, who landed from the Mayflower, was the first midwife of the Massachusetts colony. While the countries of Europe were slowly but surely improving the standards and practice of their midwives the colonies gave no attention to the matter with the result that outside of a few urban centers the program of midwife education and supervision in the United States did not begin until the twentieth century, and today we have many thousand untrained women acting as midwives. Or to put it another way, we have large groups of people in various parts of the

country for whom the only attendant available for the mother at confinement is an untrained midwife.

The first midwife ordinance in America was passed by New York City early in the eighteenth century. This ordinance dealt with the midwife's civil activities rather than her care of the mother, the only provision in regard to the latter being that in case the midwife saw the mother or child in peril she should call in other midwives for counsel, and that she would not administer any medicine to produce miscarriage.

The first officially recognized midwife school in America was established at the Bellevue Hospital in New York City in 1911.

Most, if not all, of the state laws specifically referring to the midwife have been enacted in the last thirty years. They cover such items as registration, reporting of births, use of a prophylactic in the eyes of the newborn, educational requirements, examination and licensure, and in some cases prohibitions in regard to use of drugs or instruments or attendance on certain types of cases without calling a physician. The laws also provide penalties for violation.

In order that it might have the most recent information on the midwife situation the committee sent a questionnaire to the health department of each state and territory and the Philippine Islands. The data secured from the several health departments on the number of midwives practicing and the manner of licensing and controlling them are too extended for inclusion in this concise report.

From a study of these data it may be noted that the methods of licensing and controlling midwives are distinguished by their variety. In some states the midwives must have had a course of training in a recognized school of midwifery, in others they do not have to take a course of training, but are required to pass an examination or to satisfy some state or local official that they are qualified; in still others they are only required to register, and some states have no laws regarding registration or licensure.

The reason for this variety and the low educational requirements in most states is easy to understand when the opportunities for midwife training in the United States are considered. There are but two schools; the first of these was established in New York City in 1911 and is limited almost to applicants who wish to practice there. The second school was established only a few years ago in Philadelphia. Realizing the uselessness of laws and regulations that require the midwife to have a course in a recognized school of midwifery when there are no schools available, many states have set up practical requirements which fit the local situation. Most of the midwives who have had a formal course of training providing both theoretical and practical instruction are graduates of foreign schools. Such graduates are found among the white midwives; with the exception of a few nurses

who have had a course of midwifery training, most of the colored midwives are untrained.

A very interesting educational project conducted by a private individual has been the work of a woman physician in Salt Lake City, Utah. For many years this physician has given a formal course of instruction to women wishing to become midwives and when she was in active practice the students were given practical training by accompanying her to attend her own cases. Other local physicians have cooperated to some extent in giving this practical experience.

Most of the State Boards of Health in states having a midwife problem have, in the last eight or ten years, done what they could to improve the situation either directly or through the county health departments. In the southern states, nurses, and occasionally doctors, have conducted courses for midwives in which theoretical instruction has been given, the oldest, most ignorant, and unfit of the colored midwives have been eliminated from practice, and the requirements for a permit or license raised. Work of inspection or supervision has been begun or extended. In some instances, younger and better educated women have been urged to attend the classes so that thy might replace some of the older and less qualified ones. The courses of instruction have consisted of only a few lessons in some instances and in others have been more extensive. In Georgia and South Carolina practically every midwife in the State has had the advantage of a short course of lessons. In some places, however, a midwife program has been conducted in only a few counties. In South Carolina during two successive summers, one-month courses of combined practical and theoretical training were conducted at a hospital connected with a colored school. Many colored midwives took advantage of this opportunity for a real course in midwifery brief as it was. In Kentucky a course in midwifery was given at a small hospital located in the mountain section and one class was graduated. Lack of funds prevented continuation of the course. Two national organizations which have assisted in this midwife educational program by lending physicians to conduct midwife classes are the American Child Health Association and the Federal Children's Bureau.

Many of the states where there are large numbers of white midwives have increased their supervisory work and made efforts to raise the qualifications for licenses. The most extensive work has been done in New York, New Jersey, and Pennsylvania. In all three of these states an applicant for a license to practice midwifery must be a graduate of a recognized school of midwifery or maternity hospital, or (New York and Pennsylvania) produce evidence that she has attended a certain number of confinements under the instruction of a physician. In New Jersey a postgraduate course for midwives was begun at the Jersey City hospital about three years ago and within

the last few months Cooper Hospital, Camden, has offered such a course. There is also a State Association of midwives which has an annual meeting, and a quarterly bulletin called the "Progressive Midwife" is issued by the State Bureau of Child Hygiene which has charge of the supervision of midwives.

With the exception or two or three states, the great gap in the educational work has been the lack of facilities for giving the midwife practical training and experience. The two existing schools can accommodate only a few students and it is not economically possible for midwives from a distance to attend them. There are no schools available for the colored midwife, the one in greatest need of training and the one who serves the largest number of people.

Another gap in the midwife program has been that many of the people who have sought to train and supervise the midwife have not had special midwifery training themselves. Much of the supervisory work has been concerned with birth reporting, prevention of ophthalmia neonatorum, and inspection of the midwife's home and equipment. These things are important but not sufficient.

With regard to laws and regulations, one state frankly admits that local necessity makes its laws regarding the licensing of midwives unenforceable. The same situation probably exists in other places where the officials are less frank. In Massachusetts, because of an interpretation of the medical practice act made in a court decision, midwives are not legally permitted to practice, but a survey conducted by the State Department of Health in 1921 revealed the fact that several hundred births had been attended by midwives in the six districts covered by the survey. Obviously it is not logical to institute a program of education and supervision for something that is not supposed to exist and therefore no work for the education or supervision of the midwife is carried on in this state.

In the recommendations made to the committee by State Health Officials the need for training and supervision of midwives was particularly emphasized.

MATERNAL MORTALITY IN MIDWIVES' PRACTICE

Any recommendations relative to the midwife problem must be preceded by an examination of the facts to determine the relation between midwives' practice and maternal mortality. To do this accurately it is necessary to have separate figures on the number of births attended by physicians, midwives, and others, and the number of deaths occurring in the practice of each group. Such figures are obtainable only from a few communities and so it has seemed worth while to supplement them with statistics from countries and states having a large number of deliveries attended by midwives. For purposes of this study an effort has been made to collect as many sta-

TABLE I. TREND OF MATERNAL MORTALITY IN THE UNITED STATES AND CERTAIN FOREIGN COUNTRIES*

COUNTRY	DEATHS FROM CAUSES ASSOCIATED WITH PREGNANCY AND CHILDBIRTH PER 10,000 LIVE BIRTHS													
	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
Australia	43	53	56	47	47	50	47	45	51	55	56	53	59	—
Belgium	—	—	—	—	72	60	57	53	56	58	50	61	—	—
Canada	—	—	—	—	—	—	51	55	54	60	56	57	56	—
Chile	66	73	72	82	83	75	79	80	74	61	61	58	58	47
Czechoslovakia	—	—	—	—	37	40	37	—	33[1]	31[1]	33[1]	34[1]	36	—
Denmark	—	—	—	—	—	24	20	20[1]	26	23	24	26	31	—
England and Wales	42	41	39	38	44	43	39	38	38	39	41	41	41	44
Estonia	—	—	—	—	—	—	—	—	45	40	38	41	41	—
Finland	—	36	38	44	40	36	33	30	31	35	29	32[1]	30	—
Greece	—	—	—	—	—	—	73	72	85	88	—	—	—	—
Hungary	—	42	40	52	29	32	29	30	28	31	29	32	30	—
Irish Free State	53	57	49	48	47	49	50	57	48	48	47	49	45	49
Italy	22	27	30	37	29	28	26	25	27	32	28	26	26	—
Japan	36	35	35	38	33	35	36	33	34	31	30	27	28	28
Lithuania	—	—	—	—	—	—	—	—	—	—	59	56	50	—
The Netherlands	—	—	—	29	33	24	23	25	23	24	26	29	29[1]	34
New Zealand	47	59	60	52	51	65	51	51	51	50	47	42	49	49
Northern Ireland	56	50	51	47	46	69	52	47	49	45	44	56	48	52
Norway	27	28	30	30	34	26	22	25	28	29	27	32	—	—
Salvador	—	—	—	—	—	57	57	46	50	57	50	56	63	—
Scotland	61	57	59	70	62	62	64	66	64	58	62	64	64	70
Sweden	29	27	25	26	32	27	27	25	23	24	26	—	—	—
Switzerland	—	54	56	51	57	56	55	51	46	48	43	44	37	—
U. S. birth-reg. area[2]	61	62	66	92	74	80	68	66	67	66	65	66	65	69
Uruguay	22	29	32	30	23	34	33	27	27	25	25	30	22	24

Figures compiled from official sources by the Federal Children's Bureau.

[1]Provisional.

[2]The United States birth-registration area expanded from 10 states in 1915 to 44 states in 1928.

*See also page 842.

tistics as possible from those communities where records have been kept or studies made of the number of maternal deaths occurring in midwives' practice and to compare maternal mortality rates of countries and states having large or small percentages of births attended by midwives.

United States Compared with Europe.—In all of the countries of Europe, except Scotland, more than half of the births are attended by midwives, the number being 80 per cent and more in most of them. In the United States the percentage of births attended by midwives and "others" is estimated to be not over 15 per cent. Yet every country in Europe for which statistics are available has a lower maternal mortality rate than the United States except Scotland which surpassed the United States' rate in 1928 by having one more death per 10,000 live births. The position of the United States is altered but little if the colored population with its extremely high maternal mortality rate is eliminated and figures for the white population only used in the comparison. In only one year since the establishment of the birth registration area has the maternal mortality rate for the white population of the United States been less than 60 per 10,000 live births. (Table I.)

Comparison of the States in the United States.—In comparing States with high and low percentages of births attended by midwives two points should be borne in mind: (1) that figures on births attended by midwives frequently include births attended by persons who are not midwives at all, such as members of the family and neighbors acting in an emergency through failure of the family to provide a doctor or the inability to secure one; (2) that of the women who serve as midwives only a small number are trained in midwifery.

In the United States birth registration area we find that in 1929 there were 13 states with maternal mortality rates higher than 80 per 10,000 live births. Mostly these are the southern states with their large colored population. These states also have a large percentage of births attended by so-called midwives. While the ignorant and untrained colored "mammy" undoubtedly contributes her share to this high rate, other factors which contribute to high mortality rates from all causes among the colored population and proportionately to maternal mortality are too well known for us to conclude that the high rates in the South are due per se to the high incidence of so-called midwife deliveries. In fact, statistics from three states given later in this report show a considerably lower maternal mortality rate among the colored women attended by midwives than among those attended by physicians. (Table II.)

Aside from these states we find that in 1929, 12 of the 46 states in the birth registration area had a maternal mortality rate of less than 60 per 10,000 live births. Among these twelve we find New Jersey

TABLE II.   MATERNAL MORTALITY IN THE U. S. BIRTH REGISTRATION AREA 1929, AND PERCENTAGE OF TOTAL BIRTHS REPORTED BY MIDWIVES AND OTHERS NOT PHYSICIANS 1925

STATE	MATERNAL MORTALITY RATE PER 10,000 LIVE BIRTHS[1]					PERCENTAGE OF TOTAL BIRTHS REPORTED BY MIDWIVES AND OTHERS NOT PHYSICIANS[2], [3]
	LESS THAN 60	60 to 70	70 to 80	80 to 90	90 AND ABOVE	
Alabama					99	35
Arizona			78			10
Arkansas					91	30
California	57					8
Colorado				86		10
Connecticut	54					12.8
Delaware		63				25
Florida					95	30
Georgia					93	(4)
Idaho		61				0
Illinois		68				20
Indiana			70			5
Iowa	56					1
Kansas		68				3
Kentucky		66				20
Louisiana					99	34.5
Maine			72			(5)
Maryland	55					19.2
Massachusetts		67				0
Michigan		66				5.5
Minnesota	43					15
Mississippi				89		(4)
Missouri			73			10
Montana				84		7
Nebraska		61				2
Nevada		63				10
New Hampshire			75			(6)
New Jersey	55					34
New Mexico				87		(4)
New York	56					10
N. Carolina				84		32
N. Dakota	55					10
Ohio		67				35
Oklahoma				82		2
Oregon	59					2
Pennsylvania		65				(4)
Rhode Island			79			5
S. Carolina					114	50
S. Dakota	(Not in birth registration area)					5
Tennessee				87		10.3
Texas	(Not in birth registration area)					6.2
Utah	49					10
Vermont			77			0
Virginia			71			32.4
Washington		62				5.3
W. Virginia	58					10
Wisconsin	51					7.7
Wyoming		63				2

[1]Source: U. S. Bureau of the Census.

[2]Source: U. S. Public Health Service Bulletin No. 184, Health Departments and Provinces of the United States and Canada, p. 77. (It has been necessary to use these estimates for 1925 as no later ones are available. It is suggested that this table be considered in connection with the one on pp. 7a-7k.)

[3]The following were not in the birth registration area in 1925: Ala., Ariz., Ark., Colo., Idaho, Ga., La., Mo., Nev., N. Mex., Okla., S. C., S. Dak., Tenn., and Texas. All but two states, S. Dak., and Texas, have now been admitted. It is possible that the increase in the number of registered births in these states has changed these percentages somewhat.

[4]Data not furnished.

[5]A "few" by midwives.

[6]"100 per cent reported by town clerk." (There is one practicing midwife in the state, however.)

and Maryland with 18 and 19 per cent respectively of births delivered by midwives and others, and Oregon and Iowa both of which have no midwife problem. And again in looking at the States with rates between 60 and 70 per 10,000 live births we find Kentucky and Delaware where midwives attend 18 and 25 per cent respectively of the births, with Indiana where midwives attend 5 per cent of the births and Nebraska which "has no midwife problem." In the group of states with rates between 70 and 80 per 10,000 live births we have New Hampshire, which reports one midwife in the state, and Vermont which reports none, with Virginia which has over 4,000 midwives who attend nearly one-third of the births in the state.

It is recognized that factors other than the attendant at birth affect the maternal mortality rate of a community and the above statistics are presented only to show that they do not point to the midwife as the determining factor in the high maternal mortality of any particular place.

Statistics From Communities and Special Studies.—The data secured from health departments and other agencies on the work done by midwives and from studies made of maternal mortality according to attendant at birth give us more satisfactory ground for conclusions relative to the midwife's effect on maternal mortality. In only a few studies have such statistics been assembled but enough material is available to permit of some conclusions as will be seen from the following:

Pennsylvania: In Pennsylvania a program of midwife supervision has been carried on in three sections of the state for varying periods of time, Philadelphia, Pittsburgh, and a group of counties in the coal region. Statistics are given below for these three communities.

Philadelphia: The program of midwife education and supervision was begun in Philadelphia in 1914 under the State Bureau of Medical Education. The midwives practicing there at that time were of various nationalities, speaking many languages and dialects. With the exception of a few women who were graduates of foreign schools, most of them were ignorant of any real obstetric knowledge and of elemental personal hygiene as well. The Bureau began by requiring all midwives to register and secure a license. At first the requirements were made very lenient but were gradually increased until at the present time applicants for license are required to be graduates of an approved school of midwifery. Four midwife inspectors, physicians with special training in obstetrics, were appointed whose duties were to instruct and supervise all midwives. Each midwife is required to send to her inspector a report of each case within forty-eight hours after delivery, and the inspector is required to visit the patient within a few days after delivery. If any abnormality occurs during labor the midwife must call a physician.

Statistics on the cases attended by the midwives have been kept. From 1914 to September, 1930, they attended 90,926 confinements. Of this number 1,780 were delivered by physicians and in 1281 cases physicians were called in after delivery, leaving a total of 87,865 women attended only by a midwife. All deaths occurring in the entire group, however, are considered here as deaths occurring in the midwives' practice. There were 91,074 live births (including plural births) in the group of cases, and 77 maternal deaths or a rate of 8.5 per 10,000 live births. There were 18 deaths from sepsis or a rate of 2 per 10,000 live births. The lowest maternal mortality rate ever attained in the State of Pennsylvania is 61 per 10,000 live births and the death rate from puerperal sepsis has varied from 24 to 27 per 10,000 live births during the last six years. In general about one-fourth to one-third of the deaths from sepsis follow abortions, and in order to eliminate this factor from the comparison we may reduce the state rate for sepsis by one-third, making it 16 to 18 per 10,000 live births during the last six years as compared with 2 per 10,000 live births for the group of cases attended by midwives.

The place of delivery is of interest, only 34 deliveries taking place in a hospital. One hundred and twenty-four women were sent to the hospital after delivery but in a number of these cases this was due to the fact that the baby needed hospitalization rather than the mother.

Pittsburgh: The midwife program in Pittsburgh was begun at about the same time as the one in Philadelphia. The midwives are required to pass an examination given by the Bureau of Medical Education and they are supervised by nurses on the staff of the City Bureau of Child Welfare who visit each case delivered by a midwife. During the seven-year period from 1924 to 1929 midwives attended 7,707 women. In 39 cases physicians were called in to make the delivery. There were but 4 maternal deaths in the entire group or a rate of 5 deaths per 10,000 cases.

Group of Ten Counties: In 1922 an intensive program of midwife education and supervision was begun in four counties by the Preschool Division of the Pennsylvania State Department of Health. This work was later extended to and is now being carried on in ten counties. The midwives are instructed in class groups and visited in their homes by physicians on the staff of the Preschool Division. State nurses in these counties visit all women who are attended by midwives and the doctors investigate deaths of mothers or young infants that occur in the midwives' practice. Statistics have been kept and all deaths occurring among patients attended at any time by a midwife have been charged against the midwives' practice even though the case may have been taken over and the delivery conducted by a physician. There have been 30,364 confinements attended by midwives in this

group of counties from 1925 to 1929 inclusive, with 56 maternal deaths or a rate of 18 per 10,000 confinements.

New Jersey: In a report made in 1922 by Dr. Julius Levy, Director of the Bureau of Child Hygiene of Newark, New Jersey, and Consultant to the State Bureau of Child Hygiene, he gave statistics for that city for the five-year period 1916-1921 showing that the maternal mortality rate per 1000 live births among cases delivered by midwives had varied from 1.0 to 2.2 during the five years, while that for doctors in private and hospital practice had ranged from 6.0 to 8.7

In the annual report of the New Jersey Bureau of Child Hygiene for 1928 some figures are given on the number of maternal deaths occurring in the midwives' practice. These figures show that of 400 puerperal deaths occurring in the state in that year, midwives were in attendance in only 17 instances or 4 per cent of the total. However, they attended 18 per cent of the births occurring in New Jersey in 1928. The midwives of New Jersey are probably the best trained and most highly organized state group in the country.

Maryland: In a study of maternal deaths in the State of Maryland, exclusive of the city of Baltimore for the three years 1927-1929 information concerning each case was secured by a physician who personally interviewed the person who had been in attendance on the case. There were 241 maternal deaths in the three years, 65 of which were associated with an interruption of pregnancy before the seventh month, leaving 176 deaths taking place after seven months' gestation. Of the 176 cases only 8 deaths had been attended by a midwife alone. There were 23 cases where there had been no attendant, an attendant other than a midwife, or where a physician had followed a midwife or other attendant. In 145 or more than four-fifths of the cases a physician had had entire charge.

States Included in Children's Bureau's Maternal Mortality Study.— In a study of maternal mortality made in 13 States in 1927 and in the same states and two others in 1928, by the Federal Children's Bureau in cooperation with State Boards of Health and at the request of State Medical Societies, data were secured relative to the attendant at birth. Preliminary figures on this subject have been made available to the committee.

In order to eliminate the factor of abortions which figure largely in physicians' practice, only those deaths following gestation of seven months or over are included in Tables III and IV. From one of these it will be seen that out of 4903 women dying after seven months' gestation or over, for whom the attendant at birth was reported, only 11 per cent were attended by midwives. All cases in which the midwife was in attendance regardless of whether she was followed by a physician or intern are included in this figure.

TABLE III. ATTENDANT AT BIRTH, BY STATES; WOMEN WHO DIED FROM PUERPERAL CAUSES AFTER A PERIOD OF 7 MONTHS OR MORE GESTATION IN 13 STATES IN 1927 AND IN 15 STATES IN 1928. (U. S. DEPARTMENT OF LABOR, CHILDREN'S BUREAU)

STATE	TOTAL	TOTAL		MIDWIFE ALONE		FOLLOWED BY PHYSICIAN OR INTERN		PHYSICIAN OR INTERN		PHYSICIAN FOLLOWING OTHER		OTHER OR UNATTEND		NOT REPORTED
		NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	
Total	4,903	550	11	357	7	193	4	4,065	83	47	1	241	5	62
Alabama	338	202	24	165	20	37	4	602	72	2	(1)¹	32	4	21
California²	305	12	4	6	2	6	2	259	85	5	2	29	10	5
Kentucky	424	69	16	49	11	20	5	323	76	6	1	26	6	4
Maryland	252	30	12	10	4	20	8	209	83	6	2	7	3	3
Michigan	799	18	2	8	1	10	1	743	93	12	1	26	3	10
Minnesota	334	16	5	11	3	5	2	299	90	—	—	19	6	—
Nebraska	199	6	3	2	1	4	2	182	91	1	1	10	5	1
New Hampshire	78	—	—	—	—	—	—	75	96	—	—	3	4	1
North Dakota	105	7	7	5	5	2	2	88	84	3	3	7	7	1
Oklahoma²	184	10	5	8	4	2	1	166	90	2	1	6	3	6
Oregon	96	1	1	1	1	—	—	88	92	1	1	6	6	—
Rhode Island	110	1	1	1	1	—	—	101	92	2	2	6	5	3
Virginia	566	161	28	83	14	78	14	362	64	6	1	37	7	—
Washington	168	4	2	2	1	2	1	157	93	—	—	7	4	1
Wisconsin	445	13	3	6	1	7	2	411	92	1	(1)¹	20	4	6

¹Less than 1 per cent.
²Figures for 1928 only.

TABLE IV. Mortality Among Mothers After Seven Months or More Gestation, by Attendant at Birth in States Included in the Children's Bureau Study Reporting Ten Per Cent or More of Births Attended by Midwives, 1927-1928[1]

STATE	LIVE BIRTHS REPORTED BY PHYSICIANS	DEATHS OF WOMEN ATTENDED AT CONFINEMENT BY PHYSICIANS	MORTALITY RATE PER 10,000 LIVE BIRTHS	LIVE BIRTHS REPORTED BY MIDWIVES	DEATHS OF WOMEN ATTENDED AT CONFINEMENT BY MIDWIVES[2]	MORTALITY RATE PER 10,000 LIVE BIRTHS
Four states	327,030	1,496	46	98,373	479	49
Alabama	93,843	602	64	37,176	202	54
White	78,625	389	49	6,381	34	53
Colored	15,218	213	140	30,795	168	55
Kentucky	100,312	323	32	18,763[3]	863	46
Maryland	54,812[4]	209	38	9,152[4]	30	33
White	45,665	150	33	5,288	15	28
Colored	9,143	59	65	3,860	15	39
Baltimore	27,397	114	42	4,370	13	27
White	21,667	75	35	3,760	11	29
Colored	5,730	39	68	970	2	—
Counties	27,415[4]	95	35	4,422[4]	17	38
White	23,998	75	31	1,528	4	—
Colored	3,413	20	59	2,890	13	45
Virginia	78,063	362	46	33,282	161	48
White	67,683	248	37	10,569	49	46
Colored	10,380	114	110	22,713	112	49

[1]Source: Live births from correspondence with states. Deaths from Children's Bureau study.
[2]Includes deaths of women attended by midwives alone and by midwives followed by physician.
[3]Includes midwives and others.
[4]Includes four births for which color was unknown.

Table IV, giving the mortality rates according to the attendant at birth for the mothers who died in the four states included in the study in which midwives attended 10 per cent or more of the births, shows lower rates for the midwives in two of the states and lower rates for the physicians in two. In the three states for which it was possible to compute rates separately for white and colored women, the mortality for colored women was lowest for the cases attended by midwives. In considering the figures for these four states it should be borne in mind that with few exceptions the so-called midwives are untrained women, and that therefore the figures are not so valuable as a basis of conclusions as are the ones from Pennsylvania and New Jersey.

The above statistics show very favorable maternal mortality rates in the practice of midwives in general, and remarkably low rates for the mothers attended by trained and supervised midwives.

NEED FOR MIDWIVES IN THE UNITED STATES

The question next arises, is there a need or demand for midwives in the United States? In answer to this the committee found that as nearly as can be estimated there are approximately 47,000 women in this country who at least act in the capacity of midwives; only a small proportion of them are trained women; some of them attend only two or three cases a year, but others have a large practice. Altogether, nearly 15 per cent of the births in the United States are attended by midwives and others not physicians. By states, the percentage of births attended by midwives varies from none in some states to between 40 and 50 per cent in others. In general the states with the highest percentage of midwife deliveries are the southern states with their large colored population. For the most part, the midwives who serve the colored population are untrained women. These people have to use untrained midwives because trained ones are not available and doctors cannot be afforded even if they are available. The colored midwives have shown themselves eager and willing to avail themselves of such educational advantages as have been offered to them in the way of theoretical class instruction by State Boards of Health.

The problem is not confined entirely to the colored population: in many states midwives attend large numbers of white women at confinement. The reasons for this vary. Custom, sparseness of the population and scarcity of physicians in some states, and economic conditions all play a part. As one State Health Officer in a sparsely settled southwestern state said in speaking of the situation in his state: "We must accept the midwife and attempt gradually to improve her practice. Fewness of physicians and distance people live from them make it impossible for a large part of the population to

employ them, because (1) they are not to be had at any price, and (2) because people cannot pay the fees. A trip of 100 miles at a dollar a mile plus regular obstetric fee would consume more than the entire cash income of a family for a year in many cases. The midwife in this state is an institution dating from prehistoric times. Any attempt to curtail her activities arouses a storm of protest from the Spanish-speaking population which comprises about one-half of the total.''

CONCLUSIONS AND RECOMMENDATIONS

After considering all the data which have been collected in this study and paying particular attention to the needs in certain sections of the country the committee has the following recommendations to make:

1. The ultimate solution of the problem of good obstetrics lies not in the midwife but in developing a sufficient number of doctors who are ·well trained in the fundamental principles of obstetrics. The development of such doctors is a direct responsibility of the medical schools.

2. At the present time the midwife is a necessity; she cannot be eliminated in some sections, and every effort should be made by the profession to improve her as rapidly as possible. This improvement should be brought about by local effort. Inasmuch as the midwifery need seems greatest in those states where the economic status is low, aid is needed and would hasten the relief of present conditions.

3. Recognized institutions for the training of midwives, which would assure preliminary education and proper training must be established if present conditions are to be permanently improved. The establishment of such institutions is a local and not a state responsibility. They should be located in sections needing the services of midwives and where they will not conflict with the obstetric teaching work of medical schools. It is felt that midwives trained in or near their own communities will be more likely to stay in those communities where their services are needed.

4. Inasmuch as the need for midwives seems greatest in those communities having a large colored population, it would seem wise to establish institutions for the proper training of colored midwives in the South where a wealth of controllable clinical material is available.

5. There should be provision for postgraduate courses for keeping midwives up-to-date.

6. The committee commends the good work that has been done in recent years by many State Boards of Health and feels that such work should be continued under the same supervision.

7. The committee appeals to the individual State Boards of Health to develop standards for midwife education, supervision, and control. Such standards would regulate the requirements for licensure and

insure adequate supervision by obstetricians, qualified midwives, and public health nurses with midwifery training. These problems are local and can best be solved by local administration.

8. It is suggested that midwifery training would offer the colored trained nurse a larger field of activity.

MATERNAL AND EARLY INFANT CARE*

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AFTER a year's survey of the conditions existing in the registration areas of the United States and a review of the maternal and fetal mortalities, your committee is convinced that obstetrics as practiced by the rank and file of doctors, is of very mediocre quality. In the United States there is no nation-wide system of midwifery as is found in some European countries where a large percentage of the normal deliveries are conducted by carefully trained midwives working with or under the supervision of thoroughly trained obstetric specialists. The bulk of the deliveries in our country are done by the general practitioner and in some localities by the midwife, both of whom in most instances are inadequately trained.

The committee investigated maternal and fetal mortality in hospitals and private institutions for maternity care, as compared with deliveries in the home. *Our study shows that during the past ten years there has been a gradual but consistent increase in the number of women entering the hospitals for their confinement.* This applies to both urban and rural districts. More and more women who are nonresidents apply for care and delivery in urban institutions, likewise, many cases of dystocia occurring in the rural districts are transferred to city hospitals for delivery.

Prior to 1915, there were relatively few institutions which were properly staffed or equipped to take care of maternity cases, and only a negligible number offered any form of prenatal service or gave antepartum advice. At the present time prenatal clinics are being conducted by Health Bureaus; Red Cross Chapters; Maternity Centers; Welfare Societies and District Nurse Associations, many times without regard to the importance of trained personnel or consecutive obstetric attendance.

Your committee attempted to ascertain the difference in the mortality rates between white and negro women and the causes for this difference. According to the report of the Census Bureau, of the United States Department of Commerce, the maternal mortality rate

in the birth registration areas in states having more than 2000 colored births annually for the years 1915 to 1928 inclusive, among the whites was 65.25 per 10,000 live births; while the rate among negroes was 116.58 per 10,000 live births. In certain states as Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, New York, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia, the mortality among the colored due to pregnancy and childbirth was twice that among the whites. It is evident therefore that the negro population presents a definite obstetric problem. The negroes are poorly housed and poorly fed, have had fewer educational advantages; the incidence of rachitis and syphilis is many times . greater than is found in the white woman, and gonorrheal infection among the blacks, particularly in the urban districts, is more prevalent. These factors contribute to difficult labor, puerperal infection, prematurity, and stillbirths, making both the maternal and fetal mortality rates higher.

Our third problem was to ascertain what proportion of births occurred in hospitals, what provisions were offered by hospitals for the segregation of maternity cases, and whether this segregation was done by the allocation of special wards, floors or pavilions. This data has been difficult to collect. Few of the State Bureaus have any information to give on these subjects. Your chairman instituted correspondence with a number of hospitals throughout the country and the replies show that segregation and special personnel is the rule.

In connection with this part of our study we made an effort to learn if there was any difference in the maternal mortality rate in special hospitals staffed by a trained personnel as contrasted with that in general hospitals which take maternity cases and segregate them in special wards. It was impossible to obtain sufficient statistical data bearing on this subject to draw definite conclusions, however, the mortality rates at the Chicago Lying-In; the Methodist Episcopal Maternity, Brooklyn; the New York Lying-In and the Boston Lying-In, all of which include an outpatient service, are lower than the general mortality rate of the locality and of the general hospital. Likewise, it is shown that cases attended by specially trained personnel show both a lower morbidity and mortality rate than those attended by the general practitioner in a hospital or in a home.

Our fourth problem was study of the provisions offered for prenatal care and antepartum instruction and the effect which such care has had upon maternal and fetal mortalities. It is only during the last fifteen years that *any concerted effort has been made to develop by women a demand for antepartum care and better obstetric service and to educate the physician to give this service.* Widespread propaganda for prenatal instruction is doing much to better the condition of the

prospective mother and give the unborn child a better chance. Odd as it may seem, notwithstanding this advance in preventive medicine, just as many women die of sepsis; a few less from toxemia and convulsions, but actually more from operative delivery, shock and hemorrhage, all of which demonstrates that prenatal care, no matter how thorough, is but a link in the obstetric chain which is broken by faulty or careless methods of delivery.

The United States is not alone in its high maternal and fetal mortality; England and Wales have the same problem. The recent publication of the report for the Ministry of Health by Janet Campbell, focused attention on the risk to life which attends childbirth. She shows that the mortality in England and Wales, is not only *absolutely high, but is relatively high* when compared with the rate of many other European countries. The analysis as to the causes of death serves to show that the majority of fatal cases could be controlled by preventive methods. This is a striking illustration of the necessity of better prenatal and intranatal care. In England and Wales, taking the group of married women during the reproductive age (fifteen to forty-five, there were 22,256 deaths of which number 3,456 were due to some accident or diseases of childbearing, in other words, more than one-seventh of the total death rate in this period of woman's life was attributable to causes directly or indirectly due to childbirth. Furthermore, it must be remembered that for every woman who actually loses her life in labor, *there are four or five whose health is permanently impaired by the effects of a difficult labor.*

During the last fifty years the female death rate from all causes has been considerably lowered by preventive medicine. On the other hand, in striking contrast the mortality from conditions incident to pregnancy and childbirth in England, Wales and the United States has shown very little decline *and the mortality from sepsis has remained stationary for the past fifteen years.* Deaths due to other maternal causes have also shown an increase, but with it all, there is a marked reduction in the infant mortality rate. Another observation which applies alike to England and Wales is, that the maternal mortality rate from all causes is highest in the rural areas, in contrast the *rural rate in registration areas in the United States is always lower.* These statements may be explained by the fact that there is relatively less puerperal fever in the rural districts than there are disasters from other accidents of labor. Again, as might be expected, noninterference with labor would operate in reducing the amount of sepsis but would oftentimes prevent timely aid in cases of mechanical difficulty.

In New York State the gain which has been made by prenatal care, antenatal propaganda, better, cleaner and more conservative obstet-

rics in the rural districts, is offset in the hospitals of the urban areas by a great increase in operative deliveries and the complications which follow.

Our final effort included an investigation as to the number of women delivered by midwives and how these midwives were trained, licensed and controlled, for it was apparent to our committee from all of the reports to which we have had access, that *the midwife is and will continue to be a factor in any national plan of organized obstetric care* which we may suggest or adopt.

PRESENT STATUS OF OBSTETRICS IN THE UNITED STATES

1. Provisions for prenatal care
2. Provisions for delivery
   (a) In hospitals
   (b) In the home
3. Nursing facilities and follow-up

1. *Prenatal Care.*—It is conceded to be the right of every prospective mother to have prenatal care for herself and for her unborn child. If we accept the standards of the Obstetric Advisory Committee of the New York Obstetrical Society and Children's Bureau, we find that few clinics offer complete antenatal care and instruction. By minimum Grade A care, it is understood that the woman has supervision by either a private physician or a maternity clinic from the fifth month on through the ninth. This attention should include periodic blood-pressure readings, monthly and later weekly estimation of the urinary output, uranalysis, monthly and weekly weight records and a complete physical examination including the teeth, tonsils, thyroid, lungs, breasts, heart, abdomen, pelvis, and extremities, as well as pelvic mensuration and abdominal palpation to determine the size and the position of the fetus.

Our investigation shows that there are numerous health agencies conducted by Bureaus of Child Hygiene; Welfare Societies; the Red Cross; Maternity Centers and religious organizations which are not properly staffed. Their personnel lack trained medical skill, consequently these clinics fall short in the type of antenatal care given. Heart lesions are missed or misinterpreted, anemias are overlooked, blood Wassermanns and blood chemistry are not taken; rapid increase in weight is not appreciated and the significance of mouth hygiene is neither taught nor practiced in the majority of clinics which claim to give antepartum instruction. Notwithstanding these very evident and serious omissions, it must be admitted that some good has come from educating the woman in diet, in the hygiene of pregnancy and the importance of having medical advice early in

pregnancy. Most women have learned the advantages of emptying the intestinal tract, the value of increased elimination by the copious ingestion of water, the importance of urinary examinations, blood-pressure readings; the dangers of vaginal bleeding, headache and edema, all of this knowledge has definitely lowered the incidence of eclamptic convulsions and to a considerable extent has forewarned the attendant of impending toxemia. Prenatal care has not diminished the incidence of toxemia, but it has prevented the toxemia from becoming a serious factor and has saved a large number of women and their babies by appropriate treatment and the prophylactic interruption of pregnancy.

Most of the large city hospitals both general and special which admit maternity cases have attached prenatal clinics from which their booked cases are admitted. *Study of the statistical results of such clinics where the attention is consecutive, is in striking contrast with the results obtained in clinics where there is no control of the disposition of the patient during labor.*

In the study which is being conducted by a special committee of the New York Academy of Medicine to investigate the circumstances of each puerperal death in the City of New York during a three-year period, it has been found that about 10 per cent of the fatal cases have had what is classed as Grade A care. In these groups the mortalities can be charged to poor obstetrics and poor obstetric judgment, not to a fault in the prenatal care, but indirectly to the lack of consecutive attendance.

In answer to a questionnaire sent to 1104 Health Centers, 543 stated that they were giving prenatal care. Forty-four gave only home visits. In 26 of these clinics, prenatal instruction was given by a physician, or a physician and nurse, or a physician and social worker. Among the 587 replying to the questionnaire, 231 held general conferences conducted by a physician; 162 conferences were conducted by the nurse. The majority of expectant mothers made their first visit between the fifth and seventh month of pregnancy. A complete physical examination was made in 300 and 280 had pelvic measurements recorded. All of the women applying had the urine analyzed and blood pressures taken at least three times and in a few instances as many as eight. Blood Wassermanns were done in 347 clinics and omitted in 191 clinics. Home visits were made by a nurse or a nurse and a social worker, a nurse and student, or a nurse and physician in 498 of the localities cared for by these clinics; while postpartum visits after six or eight weeks were made in 309 clinics. In answer to the inquiry, "Are prenatal services given to only those who are unable to employ a private physician?"; out of the total 587 replies, 233 answered YES and 289 NO, the remaining 65 did not report on this question. The woman received instruction concerning

nutrition in 503 of the clinics reporting. It is evident from the answers to this questionnaire that there is a concerted effort to instruct women in the hygiene of pregnancy, routine urinary examination, blood-pressure readings, the importance of blood Wassermann test and a complete examination by a physician. Less than 10 per cent of these agencies make any attempt to provide consecutive care at delivery and about half follow up the case with postpartum visits.

What may be accomplished in the conscientious management of the maternity patient through the cooperation between doctors, nurses, and associated hospitals during the prenatal, intranatal and postnatal periods, is well illustrated in the report of the Visiting Nurse Association of Minneapolis for 1929: 4,395 cases were studied, 55 per cent of the deliveries occurred in the home; 45 per cent were delivered in hospitals by physicians. Of those cases delivered in the home, 53 were attended by physicians or students, under the direction of a physician, and but 2 per cent were cared for by midwives. A visiting nurse was present in 26 per cent of the cases attended by physicians and of the total, 75 per cent received prenatal care from the Visiting Nurse Association. Fifty-one per cent received both prenatal and postnatal care.

Comparing the maternal death rates in this study with the mortality death rate in the City of Minneapolis, the accomplishment is most striking.

In Minneapolis the total births during the years 1925, 1926, 1927, 1928, were 36,940. The maternal deaths were 216 or 5.8 per 1000 births, of which only 140 were over five months gestation, giving a maternal death rate of 3.7 per thousand births. Contrasted with this in the 4,113 births having service by the Visiting Nurse Association, physician and midwife, as stated above, there were but 9 maternal deaths, *a rate of 2.2 per 1000 births.* The stillbirth rate also shows the advantage of antenatal care with a nurse and physician cooperating, being 36.7 per 1000 for the city as a whole, and 33.8 per 1000 for the 4,113 cases having visiting nurse and medical supervision.

The deduction from this study is that the earlier the discovery of complications in pregnancy the better chance the physician has to make proper plans for delivery. Cooperation between the nurse and the doctor in home care gives excellent results.

That prenatal care saves babies cannot be questioned, and that it reduces the number of infant deaths in the first month, also must be accepted. In support of this statement, comparison of the infant death rate in the first month based on figures also taken from the Bureau of Vital Statistics, City of Minneapolis, and the record of the Visiting Nurse Association, shows that in 1925, 1926, 1927, and 1928, the rate for infants under one month in Minneapolis was 37.3 per 1000 live births; under one week 25.9; under one day 19.5, as compared with

visiting nurse cases in which prenatal care was given, the infant death rate under one month was 17.4; under one week 10.8; under one day 6.2.

Causes of Maternal Mortality.—More primiparae than multiparae in the United States die during pregnancy and childbirth. Septic poisoning, toxemia, and hemorrhage (antepartum and postpartum) are responsible for 66 per cent of these deaths. In addition to these recorded causes it may be assumed that a certain proportion signed out as embolism or intestinal obstruction, may be added to the septic group, and a number of those deaths attributed to shock and myocardial failure are indirectly due to hemorrhage. All of our studies show that there is an increased incidence of operative deliveries in primiparous births, these subject the woman to tissue trauma, blood loss and infection, a combination which few women can combat. Furthermore, toxemia is actually more common in primiparae than in multiparae and, therefore, adds its toll to the grand total.

The method of delivery has an important bearing on mortality rates. This is well illustrated in a study of 370 primiparous deaths in Massachusetts, analyzed by the State Board of Health. Of this number 101 were due to sepsis and 99 to toxemia. The sudden deaths from embolism, shock and heart trouble, 78 in all, make up the next group, while hemorrhage is credited with 23. *Among these 370 deaths, 116 followed cesarean sections, 106 had been delivered with forceps, and 11 were breech extractions, a total of 233 operative deliveries.* Two hundred and twenty of the babies lived, 88 were stillborn, and 53 died immediately after birth; 103 were premature. Rather a shocking mortality with very few babies to show for it.

This and similar reports from New York, St. Louis, Cleveland, Baltimore, and Philadelphia show that surgical and manual delivery is taking a heavy toll, particularly when these mortality rates are compared with thousands of cases which have had complete consecutive antepartum and intrapartum care delivered by in- and out-patient maternity services where more attention is paid to genital asepsis and the physiologic mechanism of labor.

The mortality rates in the United States do not compare favorably with those of Scandinavia, Germany, or Italy, where the trained midwife is a part of the government organization. Rates from 2.3 to 3.6 per 1000 live births make our average of 6.5 look culpable. We who are spending millions of dollars in preventive medicine can learn much from Denmark and Sweden in the care of the maternity patient and her baby.

California, New York, Kentucky and North Carolina are doing pioneer work for bettering these conditions. California has its prenatal and maternity care well organized and the woman well educated as to the value of hospitalization at the time of her delivery. Of the 81,498 births recorded in 1929, 40,060 were confined in maternity hos-

pitals, 2792 in maternity homes, making a total of 52.80 per cent of the maternity cases which were hospitalized. The mortality rate per 1000 for hospital deliveries was 5.38; maternity homes per 1000 deliveries, 1.1 per cent. This is a remarkable record when it is considered that the hospitals and the maternity homes are "open hospitals." 38,646 women were confined at home; 7.20 per cent of the total number of births. The mortality rate in home deliveries was 5.3 per 1000 and the total rate for the state was 5.22 per 1000. In California the maternity homes and hospitals are under State supervision and comply with rigid requirements as to equipment, cleanliness, and personnel. That the importance of segregation is understood by both Lay and Medical Boards is shown by the fact that of the 249 hospitals having maternity services, 38 have separate buildings or pavilions and 178 are on separate floors, segregated from the main hospital.

The record of the Maternity Center Association of New York City affords another example of what may be accomplished by supervision and education, even though many of the patients were delivered by general practitioners, students, and midwives.*

The Bureau of Child Hygiene of California has carried on an active propaganda for the woman as well as for the education of the doctor. *Prenatal care is given by the private physician who also gives the intranatal care.* There are no free beds in California hospitals connected with the clinics except the County hospitals which have prenatal clinics attached and admit patients from these clinics. This, therefore, is a good cross-section of what can be done by the patient and the physician cooperating; for only 3,070 cases out of the total 81,498 births were delivered by midwives, this is but 3.7 per cent of the total births.

Stillbirths and Neonatal Deaths continue in a high ratio. An analysis of their causes has been unsatisfactory, as relatively few autopsies are made, hence the pathologic cause of death is seldom known. The stillbirth rates throughout the country range from 2.1 to 6.8 per cent; while the neonatal rates range from 1.9 to 4.1 per cent. In an analysis of a large series of births, the outstanding cause of infant mortality in babies under one month, is prematurity. The next largest number are credited to intranatal injury or hemorrhage.

In New York State a study of 668 completed records of the antenatal clinics which have been conducted by the Bureau of Child Hygiene of the State Board of Health, show a total of 647 live births and 21 stillbirths, a stillbirth rate of 31.4 per 1000 births. This compares favorably with the stillbirth rate of the State, exclusive of New York City which is 35.2 per 1000; while the neonatal rate is 30.9 per 1000. Fifty per cent of the neonatal mortality was due to the accidents of labor. Further analysis shows that a large proportion of

the premature births result from pregnancy toxemias and syphilis, both of which may be materially reduced by the early institution of proper treatment.

Dental Hygiene in Prenatal Clinics.—Our study has failed to show except in isolated instances that there is any dental hygiene either practiced or taught in the prenatal clinics of this country. This applies in fact to many of the clinics associated with the larger maternity services and medical schools. Most of the supervision and advice, if given at all, comes from the physician without proper consultation with the dentist. The chief dental lesions which occur during pregnancy are: (a) an increased tendency to dental caries which is explained by the calcium deficiency so common during pregnancy; (b) and an increased tendency to gingivitis. *At no period in the woman's life is dental care so necessary.* All dental operations which are indicated should be carried out except those which require prolonged general anesthesia. Ordinary extractions have little if any effect upon pregnancy and should be done when necessary. Gum infection should be treated, as focal infection is a constant producer of toxins, and it has been shown that some toxemias are dependent upon suppurative foci. A suitable tooth-building diet high in calcium content is of great value. Finally, there should be a closer cooperation between the physician and the dentist in the management of the mouth and teeth of the pregnant woman.

Another subject into which we have made inquiry is the disposition of the postpartum case after leaving the hospital; the opportunities offered unmarried mothers or deserted wives to care for their babies; what agencies assist in their rehabilitation, and also what facilities are available for mothers and babies who are syphilitic or have gonorrhea. To determine the answer to these questions, 1295 questionnaires were sent to hospitals, maternity homes and nurseries (a copy of which is appended to this report). To these, we received 542 returns which on analysis show that but 177 institutions have Social Service Departments, 208 give prenatal care to homeless women, 369 simply offer care for the delivery and 164 attempt through their Social Service Departments to find work for the unmarried mothers and the deserted wives and to assist in their rehabilitation. Altogether, 219 have the cooperation of other agencies to carry on this work, but only 116 have facilities for the care of babies while the mothers are earning a living. Two hundred and fifty-four institutions do nothing for either the mother or the baby after the first ten or twelve days of the puerperal period. Forty-five teach mothers housework, sewing, laundry, practical and child nursing, and 2 offer commercial courses which may serve as a means to the woman's support. The University of Michigan Maternity Hospital, alone, has facilities for the homeless mother both before and after her delivery. Even less

facilities are offered to the syphilitic mother or the woman who is suffering from acute gonorrhea. It is the rule to refer these patients to the venereal clinic and have them treated there. Some of the large hospitals, notably the Cook County Hospital, the Long Island College Hospital, the Philadelphia Lying-In and the Boston Lying-In, have antisyphilitic clinics for the babies. In Chicago, Miss Prentice, Director of the Social Service Department of the Cook County Hospital, states: "There are no facilities for mothers and babies who have gonorrhea with but one exception, the Salvation Army Home where they have five beds for such cases, but they prefer to take those cases before delivery and carry them through their confinement."

Nursing Facilities and Follow-Up.—The nursing facilities offered for the care of maternity cases are:

(1) The specially trained graduate
(2) The trained nurse
(3) The practical monthly nurse
(4) The trained nurse midwife
(5) Midwives graduated from foreign schools and a few from our own schools of midwifery
(6) The friendly neighbor.

The State Bureaus of Child Hygiene and Maternity Care in many states offer some nursing facilities, though in most instances this work is one of education, not bedside nursing. As a whole the nursing of maternity cases has not been developed and is inadequate. Likewise, the Visiting Nurse Associations and Maternity Center groups in the large cities, offer a limited amount of maternity nursing of good quality but this is too thinly spread over the areas which they attempt to cover. In the rural districts, the County or Village Health Department usually maintain a small nursing staff, more for instruction than for actual nursing service. One point which our investigation has brought out is, that relatively *few graduate nurses practicing in the large cities will take care of home maternity cases on a twenty-four hour basis.* The facilities for follow-up are lacking except in a few postnatal clinics which are operated in connection with some of the large university maternity services. No organized effort of follow-up has been developed in this country.

<div align="center">COMMENTS</div>

The survey of this subcommittee has shown that there is no nationwide program in the United States and has confirmed its belief that, while American obstetrics in certain urban centers is comparable to obstetrics practiced anywhere in the world, *that as a nation our women are not receiving the best care.* Apparently we are passing through a transitional period from surgical radicalism with its heavy toll to

physiologic conservatism, where by careful antepartum study; instruction in the hygiene of pregnancy; the intelligent interpretation of the laboratory findings in the toxemias; a broader knowledge of the physiologic mechanism of labor and the employment of strict surgical asepsis at delivery, maternal mortality will be reduced. To achieve this result the present standard of inadequate and casual prenatal work must be raised by the organization of prenatal clinics which are staffed by a trained personnel. It will not be difficult to do this in our larger cities in the clinics connected with the large university hospitals which are well endowed; *but giving adequate prenatal attention in the sparsely populated districts will always be a difficult proposition until the State, the physician and the patient appreciate the advantages and accept their individual responsibilities.* The small rural hospital which is the medical center of the community, could well establish both a free and a pay clinic for the instruction of the prospective mother. Each one of these institutions covers considerable territory and their facilities in this day of the automobile can be utilized without difficulty. Furthermore, all of these hospitals are open hospitals, and the physician who gives the care could have access not only to the records but to the hospital facilities. *Only consecutive and intelligent rational obstetrics at the time of delivery followed by postnatal observation for a period of two months after childbirth, will ever raise our obstetrics to proper standards.* Mothers' classes for antenatal instruction could be conducted in these centers and in this way the public would obtain a better knowledge of its responsibilities to the woman at childbirth. The laboratory equipment of these small hospitals could be used to examine the urine, determine the blood chemistry, and make Wassermann tests, while a nurse could keep the weight charts and make the blood-pressure readings. All of this data could be indexed and be available to the physician. This could be done at small cost with benefit to the hospital; (1) because it would establish a contact; (2) and would take away from the woman the fear of a hospital and educate her in the value of preventive medicine. The physician would be better trained because of the demand for better service by both the woman and the hospital.

More opportunities for graduate training in obstetrics should be offered the general practitioner by the several university clinics. This training should include advanced means of diagnosis, pelvimetry, fetometry, simple laboratory methods and offer periods of observation for the study of the proper management of the several stages of labor, for in the last analysis, it is the general practitioner and usually a busy one, who will attend the majority of obstetric cases. *The tendency for early interference before the passages are completely prepared could be minimized by the development of the obstetric nurse*

midwife. A nurse having had special maternity training in the delivery room, capable of observing the fetal heart, making rectal and abdominal examinations to determine progress; should be attached to the personnel of every busy practitioner who cares for maternity cases. Surgical cleanliness and the avoidance of trauma must always be the watchword of every man or woman who practices obstetrics.

Your committee is convinced that *the time has come to establish a nation-wide obstetric program which should have the backing of the Federal Government, the State and County Health Departments and the endorsement of the national obstetric groups and welfare agencies.* It is conceded to be the right of every prospective mother to have proper prenatal care. She should also be provided with the means and the machinery to have a safely conducted delivery. For years the National Government and the States have provided sanitorial treatment for the tuberculosis patient, how much more important it is to have a healthy child born of a healthy mother, and the woman restored to her economic value in society for the care of this and her other children. Surely no nation-wide project deserves greater support.

Any nation-wide obstetric program must plan for the care of four distinct groups of patients:

1. *The clinic patient* who receives her care in the clinic with its consecutive prenatal, intranatal, intrapartal and postpartal services; completely organized with a medical, dental, nursing and social service personnel. This group is already well taken care of in the larger cities by the maternity hospitals and the general hospitals with completely organized maternity services. Thirty-eight of our medical schools carry on prenatal clinics in connection with their maternity services and thirty-three have already established postpartum clinics for the follow-up of these patients after they are discharged from the hospital; for the study of involution changes; the correction of displacements and the management of late infections.

2. *The Rural Group.*—This group lives in the rural communities of the sparsely settled districts and includes the large negro population of the South and the Southwest where no adequate care of any type is given to the lying-in woman. In his group the State Board of Health through its Children's Bureau and the County Health Officers, must cooperate in the maternity program. A survey of the country shows that there are comparatively few districts in which there are no rural hospitals. Your committee believes that county hospitals of the rural districts, as well as city hospitals supported by taxes, should be equipped to protect mothers and babies in every station of life. In addition to the cooperation from the State Board and the County Health Officer, the small privately owned hospitals should be subsidized by the State and so organized as to form a center equipped to give consecutive

obstetric care. By this, we mean; prenatal, intranatal, intrapartum, postpartum and postnatal attention. Besides subsidizing the hospital the State should maintain a full-time Health Officer in the county in which the hospital is situated.

In the Southern States having both white and colored population, there must be not only segregation of the maternity cases, but provision of the segregation of the white from the colored. With the county hospitals and the privately owned hospitals in the rural districts offering facilities for the care of maternity patients; prenatal clinics of modern efficiency and postpartum clinics could well be part of the care offered; while the Public Health nursing staff could follow up with instructive visits in the home.

In California an instructive visit in the home is given to all mothers and babies cared for at the hospitals; this visit is free and educational in character. On the average the work is covered by two visits; the first is made the day after the patient leaves the Maternity. Nursery adjustments, such as bed, bath and a formula with a working schedule for the care of the child and care of the home, cover the instruction.

The maternity program with the necessary publicity should be begun at the marriage license bureau where every applicant should receive simple printed literature of the minimum standards of prenatal care, the importance of trained medical attendance during labor and information relative to the importance of periodic health examinations. Through the County Health Officer the maternity program of the State Board of Health can be presented to the local physicians and to the residents of the community at the County Medical Societies and lay organizations of women and the work stabilized through the permanent health centers (the rural hospitals). Each of these hospitals taking patients should offer advice as to clothing, shoes, layette, and nursery equipment, thus making a demand on the department stores for better service. All of this service should be free to private and house cases and will serve as an advertising medium for the medical prenatal service. Private physicians should be invited and encouraged to serve in these clinic centers, but the Health Officer should be the responsible head and be responsible for the type of work done in the clinic.

It must be admitted that the midwife or the trained nurse midwife is a necessity in the rural districts, particularly in the South and the Southwest, but she must be properly educated and trained. Nurse midwives, both white and black, could be trained in these clinic centers to do simple, clean midwifery and encouraged to serve the community in this type of work. It is particularly important that native women be given the opportunity of this training, as they in all likelihood will be more content to work among their friends and neighbors in the districts in which they live. Such midwife training should be regulated and financially supported by the State if other means are not forthcoming.

3. *The Great Middle Class* which makes up the majority of women who do not care to go to free clinics, is entitled to proper prenatal and intranatal care just as much as are their less fortunate sisters. These women will always be confined in the home, in a maternity home, or in an open hospital by the general practitioner or the young specialist. These women must be provided for and it is this class who must be educated by conferences, mother-craft clubs, etc.; to the benefits of modern obstetric care. Likewise, it is the general practitioner who by being given greater opportunities (graduate instruction) will be better equipped to take care of such cases. That this can be done is demonstrated by reviewing what has been accomplished in the State of California where the practitioner gives the prenatal care and delivers his patient in the home or in a maternity home. The records of the latter show that the maternal mortality per 1000 live births is only 1.1. The maternity homes in California are under State supervision, not only as to their building and equipment, but as to their personnel and their results.

4. *The Well-to-Do Patient* also needs education. She is in a position to have the best, could she know what is the best. Relatively few of this class outside of those living in the large cities are delivered in hospitals. There is, however, a gradual increase of hospitalization in almost every state. When we speak of hospitals, we mean the institution manned by a trained obstetric staff. This may be an open or closed institution, but to keep the work at a high standard there must be an impartial review of the results obtained, for unless this is the case, the hospital is not as safe a place for delivery as is the home, for it gives false security to the untrained surgically inclined obstetrician.

At the present time we can suggest no means of improving the obstetric service rendered to this class of women except by educational propaganda to the public and better education and regulation of the men who are practicing obstetrics; by a review of their mortalities by the Health Officer, and in larger cities by a group representing the American Board of Obstetrics. The flagrant abuses such as operative interference on flimsy indications, the employment of questionable methods of procedure and careless unsurgical attendance, could be brought to the attention of the offending individual and a better quality of work would result.

In conclusion your committee recommends:

1. The establishment of a nation-wide obstetric program which has the support of the Federal Government, the State and County. State Maternity Hospitals, especially those in connection with Medical Schools and urban hospitals may also require financial support. This means subsidizing county and privately owned rural hospitals as obstetric centers.

2. That greater opportunities be offered the general practitioner by the University Medical Schools for graduate instruction in obstetrics.

3. That national schools of midwifery for the white as well as for the negro woman be established in connection with the rural hospitals in those districts in which the midwife is a necessity. In this plan the midwife shall be responsible and supervised by trained obstetricians in their respective districts, as is the plan in Scandinavia.

4. That the obstetric care does not terminate when the patient is discharged from bed, therefore, we recommend that postpartum and postnatal clinics be established for the poor and for those in moderate circumstances and that the physician be schooled in the importance of postpartum care. If the childbearing woman is, as we all agree, a national asset, she is entitled to national recognition and national support.

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FACTORS AND CAUSES OF FETAL, NEWLY BORN, AND MATERNAL MORBIDITY AND MORTALITY*.

By Hugo Ehrenfest, M.D., St. Louis, Mo.

THE Report herewith presented includes a total of 25 reports which analyze and discuss a large number of different factors and causes of fetal, newly born, and maternal morbidity and mortality.

The appended list of authors, and titles of their contributions, clearly indicates the great variety of factors investigated by men believed to be specially equipped by experience and personal interest to handle their respective problems, but this list fails to convey any adequate idea of the impressive amount of reliable information and of valuable suggestions offered.

Of necessity this report is limited to a brief presentation or even only mere mention of particularly important views and conclusions in regard to causes for the present maternal, fetal and neonatal mortality and morbidity, and to their possible elimination.

A tremendous loss of life occurs during the first few months of intrauterine existence. The mortality during the six months preceding viability apparently surpasses the total mortality from that time to the age of sixteen years. Available statistics establish for all the civilized world a continuously rising incidence of abortions as the direct result of a steady increase of willful interruptions of pregnancies. Useful statistics, however, in regard to either spontaneous or intentional abortions, or of maternal mortality and morbidity connected with them are not obtainable.

All attempts to enforce systematic reports of abortions to health officers have failed. Similar concealment and falsification exist in reporting the deaths of mothers due to abortion. This probably is the inevitable result of the fact that induced abortion is not only considered immoral by the community but is punishable as crime. In modern Russia both these factors have been eliminated by legalization of abortion under certain conditions, and from this viewpoint recent Russian statistics prove of interest and value. In the Ukraine district alone, the number of recorded abortions amounted in 1925 to approximately 89,000, but within the next two years they rose to 150,000 and 242,000 respectively. They were legally and thus expertly performed, according to the claim of the Russian authorities, with a maternal mortality of practically zero. With reasonable accuracy a similar, remarkable increase of abortions has been established as well in

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*Report of Subcommittee IV, on Factors and Causes of Fetal, Early Infant, and Maternal Morbidity and Mortality.

Germany, the ratio between abortions and term births in 1927 being calculated to amount to approximately 1 :1.

No data concerning abortion incidence are available for the United States, as recently stated by the Children's Bureau. Investigations made by this Bureau for the years 1927 and 1928, however, among others revealed the important facts, that about 25 per cent of all maternal puerperal deaths followed abortions, and that such deaths after illegal abortion were caused by septicemia in 91 per cent of the cases. The Children's Bureau estimates that of all abortions in this country 50 per cent are criminally induced, 37 per cent spontaneous, and the remaining 13 per cent therapeutic. One familiar with existing conditions will admit that a considerable number of the so-called therapeutic and very many of the spontaneous abortions actually belong in the group of criminal abortions.

Efforts to reduce this appalling waste in early fetal life are bound to meet with serious obstacles. Prenatal care has helped, and will help more if better and earlier care is sought by expectant mothers. Church and state for a very long time have been vainly fighting against criminal abortion. Among the causes which today induce so many women to interfere with an existing pregnancy there can be recognized at least two which cannot be eliminated, namely, a reduced infant mortality and changes in social-economic conditions. Whether perfection of contraceptive means and their wider usage will actually decrease the number of induced abortions seems debatable, if not actually doubtful.

Much, however, can and must be done to reduce the present high maternal mortality and morbidity connected with abortions. Routine hospitalization of all these patients would greatly facilitate their adequate medical management and eliminate dire consequences in many instances.

Next to abortion as cause of maternal, fetal and neonatal mortality and morbidity rank diseases which either precede impregnation or appear as complications in the course of pregnancy. Special investigations and studies made by members of this committee deal with the following diseases more commonly observed among pregnant women: Syphilis; tuberculosis; cancer; anomalies of kidneys, heart, certain endocrine glands, blood and teeth; the acute infectious diseases; parasitic infections; toxemia. On account of its close relation to conditions belonging in this group, in this connection mention is made of an investigation concerning the effect of pelvic, therapeutic irradiation on subsequent offspring. As far as possible the manifold interrelations between pregnancy and such diseases were systematically discussed from the following viewpoints: How is pregnancy likely to affect the usual course of the disease and the prognosis as to life and future health of the mother? What effect can the disease be

expected to exert on continuation of the pregnancy to term, on the fetus, the newborn, or the child later in life? How shall the complicating disease be treated, how labor, delivery and the puerperium managed? How can the development of such diseases in the course of pregnancy be prevented? In cases of disease already existing, when is a warning against marriage desirable, under which conditions is it advisable to prevent temporarily or permanently an impregnation, and when justifiable to interrupt a pregnancy?

A few of the facts developed in these studies deserve specific quotation.

The responsibility of discovering syphilis in pregnant women largely rests with the general practitioner. The fact that a negative Wassermann does not exclude the presence of this disease should be more generally known. It is probable that a cross-section of the incidence of syphilis among pregnant women in the United States amounts to about 10 per cent, but is much higher among negroes. Syphilis does not increase the immediate maternal hazard. Proper treatment, instituted early, will practically in every instance prevent the baby from having the disease.

There is now a definitely growing opinion, particularly among experts in tuberculosis, that the heretofore rather general claim of a deleterious effect of an intervening pregnancy on an existing pulmonary tuberculosis is not based on acceptable facts. Indeed, marked improvement of the disease becomes the rule, when the pregnant woman receives proper treatment during pregnancy, labor, the puerperium, and for a considerable time afterward. Therefore, any routine or even frequent interruption of the pregnancy for the assumed benefit of the mother is not any longer justifiable.

The satisfactory solution of the important problem of efficient dealing with tuberculous, pregnant women thus rests mainly with a sufficient supply of hospital beds for such patients. A recent investigation showed that in this country the situation in this respect is quite far from being satisfactory; that in the United States a tuberculous woman unjustly is penalized for having become pregnant; that improvement of such regrettable conditions depends less upon an increase of beds or special equipment than upon a change in the viewpoint of the directors of such institutions. There might be required a better and wider distribution of such hospitals and centers, or a more carefully supervised transfer of delivered women to such places. Surely the tuberculous pregnant woman should not be left to the haphazard and inadequate care she has all too frequently received in the past.

The most important single factor in the tuberculosis problem is the recognition of the lesion very early in pregnancy. Prenatal clinics fully appreciate this fact, general practitioners and the patients them-

selves, however, only to a very limited degree. Women with signs of active tuberculosis should be warned against pregnancy and if they nevertheless conceive should immediately receive adequate treatment for their disease, preferably in a sanitarium or its equivalent.

Cancer is one of the rarer complications of pregnancy. If in a state where cure seems possible the disease should be treated without any consideration of the pregnancy. When the malignancy is advanced, efforts must be directed concerning a possible saving of the child. A patient, seemingly cured of a malignant disease, should not be permitted to go through a pregnancy.

It is regrettable that so far no uniformity of nomenclature has been established for the various types of renal disease encountered in pregnant women. It is evident that each patient presents a specific problem and that frequently it is impossible to determine the character and extent of kidney involvement until several weeks or months after delivery.

Acute nephritis occurs, but only rarely it can be differentiated from the more common acute pregnancy toxemia, variously designated as preeclampsia or eclampsia. Also only rarely it is possible to differentiate clinically between the various forms of chronic nephritis.

Of serious import is the relative frequency of chronic nephritis following eclampsia, preeclamptic toxemia and the so-called albuminuria of pregnancy.

When the kidneys already are damaged, or become so during pregnancy, the added strain of gestation in many cases lowers the kidney reserve to such a degree that the patient's welfare becomes seriously jeopardized. In instances of chronic nephritis, pregnancy should be prohibited and in many cases the interruption of pregnancy becomes necessary. All cases of toxemia must be carefully observed for at least one year after delivery before another pregnancy could be allowed.

In patients who had previously one kidney removed the remaining kidney must be subjected to a careful study before a pregnancy could be permitted.

Disturbances of pregnancy to which the general title of toxemia is commonly applied are about as far as ever from final solution with respect to incidence, etiology and treatment. Recent researches in regard to causation have been largely along chemical lines. The most satisfactory scheme of treatment, in general, represents adherence to symptomatic, conservative as contrasted with radical, operative measures except under certain conditions. Earlier recognition of premonitory symptoms under proper prenatal care beyond any doubt has resulted in the reduced incidence of eclampsia.

Like the kidney also the heart during pregnancy is called upon to augment its function. Physiologic alterations in the circulatory sys-

tem during gestation at times make it difficult to draw an exact line between them and truly pathologic changes. The already damaged heart stands less chance to respond efficiently to the additional demands made upon it by pregnancy and particularly during the second stage of labor. The chief objects of management of cardiac patients are early recognition, and prevention of a circulatory breakdown. This usually can be accomplished but of the one per cent of pregnancies ending fatally about one-fifth is caused by heart disease.

No attempt at delivery should be made while the patient is acutely decompensated. A thorough trial with medical treatment must precede any surgical action. The effect of such treatment as a rule is as satisfactory in the pregnant as in the nonpregnant woman.

If a cardiac woman during pregnancy exhibits the signs of circulatory failure, a decline in cardiac efficiency as the result of childbearing is to be expected. In a subsequent pregnancy an exaggerated insufficiency is likely to prove fatal. A heart that has broken down once should never again be exposed to the strain of pregnancy. Cases with prompt and complete restoration of circulatory balance have a better prognosis.

Delivery always should be made as short and effortless as possible.

Premature expulsion of uterine contents occurs in a high percentage of cases. A short second stage of labor seems of great advantage not only to the mother but as well to the baby.

A factor to be reckoned with is the effect on the cardiac patient of the burden of an enlarged family. This factor alone in some instances might make permanent sterilization desirable.

With present methods of dealing with functional anomalies of the thyroid gland interruption of pregnancy becomes but rarely necessary. Hypothyroidism can be effectively managed with the administration of thyroid extracts. In some of the hyperthyroid patients compound solutions of iodine might prove not entirely sufficient and then a partial thyroidectomy has to be done. Under these conditions the pregnant woman as a rule is enabled to carry through pregnancy with reasonable expectancy of health and of a normal living child born at term.

There is no evidence that children of hyperthyroid mothers have abnormal thyroids; it seems, however, that children of untreated hypothyroid mothers show a higher incidence of colloid goiters in infancy.

In the presence of hyperthyroidism medical advice must be strongly against pregnancy.

With the introduction of insulin in the treatment of diabetes a remarkable change to the better has come in the heretofore grave prognosis for both mother and fetus. Successful treatment of diabetes, whether patient is pregnant or not, depends upon meticulous con-

trol of insulin administration, diet, activity, etc., and for this reason the advice to be given to a diabetic woman in regard to a pregnancy in its last analysis really is determined by external conditions. When, however, in a preceding pregnancy in spite of adequate treatment the outcome was unfavorable, it seems logical to forego any further attempts.

Exhaustion during labor should be guarded against in these patients and to that end operative delivery with the patient in good condition is probably preferable to a long-drawn-out labor.

As far as the pregnant woman is concerned only the chronic myeloid leucemia holds any practical interest. Many women suffering from this disease have been known to pass through two and even more labors. Nevertheless, these women must be strongly warned against pregnancy. The customary treatment with irradiation has its definite drawbacks in view of the probable harmful effect on the fetus. Interruption cannot be expected to prove useful since any operation on a leucemic patient admittedly implies considerable risks.

Slight anemias are relatively common especially in the later months of pregnancy; severe anemias, due to various causes, on the other hand, are infrequent. The maternal mortality in cases of pernicious-like anemias is exceedingly high. Severely progressive anemias are apt to be accompanied by fetal death or premature labor.

Patients suffering from severe anemias must be warned against pregnancy, at least until blood examination shows a return to normal. Every patient of this kind should know the particular danger of closely repeated pregnancies. The wisdom or necessity of artificial interruption of pregnancy in far advanced cases of anemia may well be questioned.

Splenectomy may be a life-saving procedure in cases of acute purpura hemorrhagica at any state of gestation and in some rare instances of hemolytic jaundice, though these latter patients usually stand pregnancy fairly well. Splenectomy during pregnancy is usually followed by an undisturbed labor and puerperium.

All the known infectious diseases might accidentally complicate a pregnancy. Most of them under these conditions are prone to run a more serious course; to carry a larger mortality, and to interfere with the progress of pregnancy when associated with marked toxemia or high elevation of temperature. Some of them distinctly increase the chances of puerperal infection. Interesting in this connection is the possibility of a passive, usually only transitory, immunization of the fetus as the result of transition of antibodies through the placenta. Such transmission of antibodies also occurs by way of the mother's milk.

The many different forms of parasitic diseases in general cause many abortions or premature labors, but with the exception of hookworm do not constitute an unusual hazard for the infected mother.

An effort should be made to diagnose such a complicating parasitic infection correctly and early with the aid of an expert so that appropriate treatment can be started at the earliest moment. This gives the fetus the best chance.

Malaria produces abortion, but quinine given to the patient actually prevents it. Even the malaria inoculation treatment of paresis can be successfully administered to pregnant paretic women. Dengue is a most serious complication of early pregnancy. Prenatal infection of the fetus with hookworm can occur through migration of larvae. Ascaris may cause not only severe symptoms but serious complications of pregnancy.

The entire problem of parasitic infection is one of great portent especially for the Southern states. It has so far not been accorded the study of its relation to pregnancy it fully deserves. For that part of our country fecal examinations should become a part of antenatal routine.

With the wider use of pelvic irradiation in the treatment of gynecologic diseases naturally a question has been raised in regard to a possible harmful effect upon a subsequent child. Most exhaustive studies and investigations made by one member of the committee demonstrate beyond all reasonable doubt that preconceptional irradiation is harmless as far as the future child is concerned. In contrast, postconceptional application of radium or x-ray in larger doses for therapeutic purposes to the pelvic region implies a great risk of damage, especially of the fetal central nervous system. Such treatment should always be preceded by curettage. Patients must be warned against exposure to possible impregnation when the application of the rays is done in intervals. If radiation is absolutely required during pregnancy or impregnation accidentally occurs during the course of treatment, the uterus should be emptied promptly.

Short exposure for roentgenograms during pregnancy most probably is entirely free of any harmful effect on the fetus, granted that this procedure is not too often repeated, especially in early pregnancy.

Of recognized importance in the causation of mortality and morbidity of both mother and infant are traumatic lesions and infections sustained in the course of labor and delivery.

Competent antenatal examination and continued observation in many instances will enable the attending physician to foresee difficulties likely to arise from pelvic anomalies and abnormal fetal presentations. In respect to the latter, timely recognition of a breech presentation and its correction by means of an external version, gently done without anes-

thesia, must be accorded first place among efficient prophylactic measures in the protection of the child.

The intimate relation of the injury of the child in birth to his immediate or early death, and to a later physical or mental deficiency at present is generally appreciated. Intracranial damage as the most frequent type of such injury naturally plays the most important rôle in the causation of stillbirth, neonatal mortality and infant morbidity. Concentration of medical interest on this one type of injury in the minds of many has made the general term "birth injury" almost synonymous with the term "intracranial injury." Thus the significant fact becomes obscured that birth injuries, sustained more often in artificial deliveries but not by any means rarely in normal spontaneous labors, comprise outside of cranial and intracranial damage also fractures of the vertebral column, clavicle, jaw, upper and lower extremities; palsies of the brachial plexus or facial nerve; more or less severe eye injuries including complete avulsion of the eyeball, include severe injuries to abdominal organs particularly in the course of brusque manipulation during resuscitation, and many other forms of possible traumatic lesions.

Parallel with an increase of our knowledge concerning immediate and late effects of such injuries runs a corresponding decrease in the number of diseases and anomalies of infants, commonly termed as congenital. Many of them we find to have been actually acquired in birth.

Responsibility for any of these injuries does not necessarily rest with the obstetrician but their occurrence certainly to a considerable extent is influenced by his judgment and skill. This is particularly true in respect to all artificial and operative deliveries. Even when done by experts under most favorable conditions they augment the risk to the mother and with the sole exception of cesarean section as well as to the baby.

Advocates of more radical obstetrics seem to disregard or to minimize the inevitable dangers of such practice. It seems unthinkable that the conscientious obstetrician would increase maternal risks in the hope of compensation by an entirely problematic improvement of future chances for the baby.

Artificial delivery is becoming increasingly frequent, especially in hospital practice, chiefly as the result of four factors: (1) A sense of safety, often false; (2) the almost universal use of anesthetics in response to the demands of the patients; (3) an exaggerated idea of the value of the infant's life and of the value of operative delivery in conserving this life; and (4) the often false idea that artificial delivery is easier on the mother, incidentally an idea which complies with the present demand of women for a short labor.

Cesarean section is the safest form of delivery as far as the child is

concerned but experience shows that women once subjected to this operation almost invariably resort extensively to contraceptive measures. Thus efforts to save babies under exceptional indications by means of this operation as a matter of fact in the end result in a reduction of their number.

As far as the use of the forceps in general practice and especially in the home of the patient is concerned, objection hardly could be raised to the assertion that a reduction of the present high incidence of damage to mother and child can be secured only by a limitation of the number of forceps extractions.

Pain relief of the parturient is desirable, but the problem is essentially different from anesthesia necessary for all operations. Relief given to women in labor must be absolutely free of all possible harm to either mother or child. Of the various drugs, for this purpose administered by mouth, rectum or subcutaneously, the overwhelming majority interfere with uterine activity and many pass into fetal circulation. Among the various types of inhalation anesthesia, nitrous oxide with oxygen probably is the safest and most satisfactory, with ethylene and oxygen ranking next. The latter also proves valuable for deeper anesthesia required for operative deliveries but under certain conditions can be advantageously replaced by block or local anesthesia. With every type of analgesia or anesthesia during labor the fetal heart must be carefully observed. In this respect inhalation anesthesia in contrast to drug anesthesia offers the great advantage of allowing prompt cessation of administration in the interest of the fetus, when alterations in the fetal pulse rate suggest beginning distress.

Asphyxia of the newborn, that is, any immediately noticeable anomaly of respiration, in a very large number of instances is due to some damage of the respiratory center. Every seemingly asphyxiated infant, therefore, for its best advantage should be regarded as one presumably intracranially damaged. All resuscitation efforts must be gentle. Brusque manipulations not only tend to aggravate already existing lesions but by themselves are responsible for various types of often serious traumatization. Whenever an intracranial injury is suspected 20 c.c. of parental blood should be injected hypodermatically as a useful prophylactic measure.

If definite conditions justify the artificial start of labor, the artificial rupture of membranes particularly when preceded by the administration of castor oil and quinine, according to a recent investigation reported to this committee, represents the safest and most satisfactory procedure at present known. However, stress must be laid in this connection on the many evident dangers to the infant resulting from premature birth.

An investigation made through questionnaires by a member of the

committee showed that some entirely satisfactory standard technic in dealing with the newborn baby is in force in every larger maternity of this country.

In my own opinion, however, every hospital and private record of labor and delivery should not only describe with sufficient detail all phases of the process but should as well contain exact references to any anomalies in the condition and immediate behavior of the baby. With increased frequency now the attending obstetrician is asked for such precise information by pediatricians, neurologists and orthopedists, years later consulted concerning certain diseases or defects possibly the result of birth injuries.

If it is true that in this country abortions account for 25 per cent of the entire puerperal mortality, and septicemia for 91 per cent of all criminal abortion deaths, then septic infection following full-term labor certainly does not play as important a rôle in puerperal maternal mortality as we generally are led to believe.

Better prenatal, intranatal and postnatal care nevertheless would hold out promise for further reduction of this mortality and beyond doubt would eliminate a great part of puerperal morbidity.

There is no agreement as to what constitutes puerperal morbidity and even the standards based upon certain temperature levels leave out many cases in which the temperature never reaches 100° F. but nevertheless are morbid as evidenced by a thrombotic process or subinvolution. A decided step forward would be made by general acceptance of a precise definition of the term "puerperal morbidity." Such a definition, however, would have to include such details as the manner (mouth, rectum or axilla), time and interval for ascertaining the temperature.

Puerperal morbidity statistics as now offered from various sources are incomparable with each other and of limited practical value. An investigation made by means of questionnaires revealed that large maternities in this country, even with standards approximately the same, report figures for this morbidity which vary anywhere between 7.6 per cent (the lowest reported) and approximately 30 per cent. The actual puerperal morbidity in the whole country thus cannot even be estimated.

It seems superfluous to enter here into a discussion of well-known local sources of infection and fever. Among extragenital causes of fever, first place apparently is held by respiratory infections, followed next by uncomplicated pyelitis. The figure for breast infections in obtained reports probably is relatively too small on account of the frequent start of this trouble after the tenth postpartum day. Of various surgical complications, usually representing acuter exacerbations of old processes near the genital sphere, can be mentioned salpingitis, parametritis, bartholinic gland abscesses, appendicitis, tonsillary abscesses

and cholecystitis. Appendicitis in this connection is of particular importance. Whenever a definite diagnosis of appendicitis can be made during pregnancy, it is best to remove the organ. Any of the medical conditions causing fever might occur during the puerperium. All cases of fever during the puerperium should have the advantage of careful physical examination by an internist.

The incidence of infections of the genital tract is increased by all vaginal manipulations, and particularly, by all types of operative delivery. It seems possible that all the advances in medical knowledge have been almost lost to the parturient woman through too great a recourse to instrumental delivery. The average woman in this country at present seems less concerned with the dangers incident to operative interference than with the desire to pass through labor as quickly and comfortably as possible.

Hospitalization of parturient women is constantly increasing all over this country and in the ten largest cities now ranges between 56 and 85 per cent of all live births. This has many decided advantages but as well such disadvantages as exposure to cross infection, and, as already mentioned, the often false feeling of security of the operating room. This latter factor undeniably has led to much unnecessary operating with its resulting trauma and increased morbidity and mortality. The operative rate for confinements amounts to 15 per cent in Scandinavian countries and England, in this country to between 65 and 80 per cent according to 20 answered questionnaires.

Allowing doctors in the community to care for their own patients in the hospitals, provided that they rigidly adhere to the established technic, in general has proved advantageous. More and better equipped maternities with a better trained personnel, reduction in operative deliveries, prevention of abuse of analgesia and anesthesia, better education of mothers in respect to the advantages of good antenatal care and the inevitable dangers of satisfying their desire for painless and short labor represent the best prophylactic measures now available for reduction of the present maternal mortality and morbidity from inadequate intranatal care, trauma and infection.

True morbidity in the puerperium not necessarily manifests itself by fever. Retained parts of secundinae may cause hemorrhages, at times of a serious nature, and will favor infection and subinvolution. Unattended damage to soft parts becomes responsible for various troublesome affections. Breast infections can be avoided by proper care. By means of a questionnaire a clear view was obtained in regard to prevailing opinion as to what constitutes proper postpartum care. The bladder should never be allowed to become overdistended. An increasing number of obstetricians in this country are dispensing with the

tight abdominal binder. Certain exercises during the lying-in period are advantageous. More than one local examination should be made after labor.

This particular report concludes with the statement that for the best interest of the patient another conception should not take place at least within the next six months and that, therefore, at the time of the last postpartum examination advice should be offered for its prevention.

It seems convenient to summarize at this point opinions freely expressed in many of the reports in regard to the advisability or necessity of preventing pregnancy when the woman's health is impaired.

No objection seems possible to the assertion that young women suffering from certain forms of cardiac, renal, endocrine, infectious, malignant or mental diseases should be advised against marriage. If the patient seeking medical advice is married, the warning against pregnancy and particularly a definite decision in favor of temporary or permanent prevention of impregnation will in each individual case depend upon the character and extent of the disease and inevitably, at least in part, upon careful consideration of other conditions among which the patient's social-economic status will carry considerable weight.

Expressed views concur in the belief that earlier and wider use of prenatal examination, better understanding of the complex effects of pregnancy and disease on each other, advance in delivery methods and technic among other factors have steadily decreased the number of diseases and of individual cases in which interruption of pregnancy can be done with any justified hope of thereby materially improving the patient's chances for life or later health. This thorough modification in time-honored opinions is best illustrated in regard to pulmonary tuberculosis.

Such a change toward conservatism when it comes to choosing between two serious dangers to the mother, continuation of pregnancy to term or immediate interruption, only emphasizes the importance and necessity of an effective prophylaxis against pregnancy. In certain instances the advantage of permanent sterilization will be easily recognized and, indeed, in several states this procedure is legally required even for conditions which in the opinion of authorities not always justify the operation. There remains another, fairly large group of women whose physical condition leaves no doubt in the mind of the consulted physician that its further deterioration could be reasonably or definitely expected from impregnation within a given time. It seems logical that he should suggest and, on request, should give to them information in regard to known contraceptive methods but always with the warning that no method is known to the medical profession which is fully dependable. From this viewpoint contraception must be regarded as an item of great importance in the desirable elimination of factors which admittedly play an important rôle in maternal mortality and morbidity.

In a country with so large a population of Negroes, Indians and Chinese it seemed possible that certain racial superstitions and customs in connection with pregnancy and labor might tend to increase mortality and morbidity of mother and child. Three investigations made along these lines furnished no significant support for such an assumption. The undeniably higher maternal, fetal and infant mortality and morbidity among Negroes is determined to the largest extent by the relative frequency of contracted pelves and the notoriously high incidence of venereal infections, and in part as well by lack of cleanliness and utter ignorance concerning the first principles of hygiene or the advantages of good natal care and of adequate nourishment of the infant. Their many superstitious procedures as a whole are fairly harmless. Satisfactory or full information in regard to various Indian tribes was hard to obtain. In general, conditions in the various reservations are not by any means bad and health nurses occasionally praise the skill of some of the older, absolutely untrained native midwives. One of the reporting physicians ventures the opinion that in relation to obstetrics the "medicine man" of the tribe probably does no more harm than the faddist in the city. The younger generation of Indian women readily accept the advantage of better maternity care whenever offered to them. The same holds true for the Chinese in San Francisco, where a thorough and competent survey showed that mortality and morbidity for both mothers and babies compare most favorably with those reported by the Health Department for the entire city.

In the course of these investigations it became evident that the statistics as at present published by the Bureau of Census, by state and city health departments, and from other sources fail to offer any really clear and satisfactory insight into the actual and immediate causes of the death of either mother or newborn infant. A special study, therefore, was made of this specific problem.

Since establishment of the Birth Registration Area, with some degree of accuracy rates are computed between infant and maternal mortality based upon the total number of live births. These rates are useful for certain observations and deductions but are not comparable with similar rates of foreign countries and not even with rates of various parts of the United States. Considerable progress will be made in this respect by general adoption of the International Classification of Causes of Deaths and of Joint Causes.

It is, however, particularly desirable that a general agreement be reached as to what items should appear on the standard certificates of birth and death, especially as related to maternal and early infant mortality.

It might reasonably be expected that through certain changes in these certificates as now used, and through enforcement of exact answer to

each question on them, specific and detailed information will be obtained which is indispensable for any systematic effort on the part of obstetricians to reduce or eliminate factors and causes which today contribute to mortality and morbidity of mother and infant in connection with pregnancy and labor.

The following recommendations are made:

1. Efforts must be increased to provide better prenatal care to more women. In general, only early diagnosis allows adequate treatment of a disease which complicates pregnancy and is likely to harm mother or baby.

2. A warning should be disseminated that compliance with the insistent demand of women for shorter and more comfortable labors inevitably implies risks both for mother and baby.

3. Interference with pregnancy or labor should be limited to well-defined indications.

4. In view of the fact that abortions are responsible for a large part of maternal mortality and particularly for later maternal morbidity, at least all febrile cases of abortion should be hospitalized.

5. Appropriate changes should be made in official Birth and Death Certificates so that more and preciser information can be obtained concerning the actual causes of death of either mother or infant in connection with pregnancy and birth.

THE BASIC SCIENCES AND THEIR RELATION TO MATERNAL AND FETAL PROBLEMS*

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THE findings and implications of human genetics and eugenics must be considered carefully in any program dealing with the welfare of mother and offspring since they send ramifying roots into the fundamentals of many problems involved.

Infant mortality studies begin with ova which may be nonviable, too weak to unite with the sperm, or incapable of implanting after union. Egg and sperm may be incompatible, leading to death of the zygote, early or late; this is supposedly the cause of a large part of early spontaneous abortions, but the catastrophe may be delayed sufficiently to result in a stillbirth, early infant death or a viable cripple. Studies of such lethal and sublethal genes may yield somewhat to analysis in many instances, but these results offer little hope for control, since fatal combinations will occur only occasionally even

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in a stock carrying lethal genes. In this connection irradiation of pregnant women is commonly held to be productive of defective children, while animal experimentation suggests the possibility that women not pregnant may, nevertheless, incur changes in the germ plasm that appear later as harmful, probably recessive, mutations. So-called racial poisons, however, damage by direct action, not by genetic changes.

The genetic factors governing the pregnant mother and her placentation are virtually unknown. Placenta previa, ectopic pregnancy, position of the fetus in utero, prematurity, ease of delivery, lactational capacity, the effect of the mother's age on the character of the offspring, contracted pelves, all these present opportunities for investigation on which obstetric records could throw light.

Questions pertaining to the sex determining mechanism, the level of metabolism in the two kinds of embryos, the primary sex ratios, the sex ratio in intrauterine mortality, deviations from the normal sex ratios, aberrations in the development of the reproductive system, sex limited and sex linked traits, these, again, are fertile and stimulating lines of inquiry. In addition, a much more extensive and intensive study of the inheritance of special traits and characteristics of all kinds is highly desirable.

Consanguineous marriage, by which recessive traits, when doubled, come to expression, is of practical importance in a eugenic consideration of child welfare. In general, if specific, undesirable traits have not appeared within three generations of a proposed cousin marriage, the danger of such a union is merely that of a random mating. Dominant traits are already apparent in such parents; they become significant only if the mechanism of inheritance is such that a double dosage intensifies a minor anomaly into a defect incompatible with life. Assertion that racial crosses tend to be sterile is without support, as is also, apparently, the claim that they tend to produce disharmonious results by which the offspring is penalized.

Studies of the birth rate and infant mortality rate in various strata of the population and in specific important groups are prerequisite to any intelligent course of eugenic action. One does not know, for example, the birth and infant mortality rates of the feeble-minded as compared with the normal and superior intellect.

Investigations seem to indicate that "saving the babies" in the first year of life tends, beyond a certain point, to increase the mortality in the succeeding years. Even part of the reported decrease in infant mortality in the last century is a bookkeeping gain due to the better registration of infant births, thereby increasing the denominator in the fraction represented by the ratio of deaths over births. Some of this effort to keep alive individuals past the reproductive period is dysgenic because it perpetuates weak strains.

Any long-time program for the reduction of infant mortality must be given a eugenic orientation. This means, besides the attempt to save every possible human life, the adoption of a population policy which will safeguard racial progress. Such comprehensive proposals include: (1) a reorienting of education with more biologic subjects taught; (2) more publicity of superior pedigrees, represented possibly as a ''eugenic quotient'' compounded from the intelligence quotient, a measurement of general good health and a measurement of sound ancestry; (3) organized provision of a more normal social life for superior young people eligible for marriage; (4) information bureaus on problems of reproduction, heredity and personal adjustment; (5) physical examination before marriage; (6) provision for advance notice of intention to wed, for the discouraging of freak, fraudulent, runaway, drunken and other unwise marriages; (7) discouraging or preventing the reproduction of those whose offspring are pretty certain to be unfit; (8) encouraging the birth rate of the fit; (9) adequate immigration control, not only in numbers but in quality; (10) restriction of war; (11) promotion of continuous research in everything pertaining to the establishment and perpetuation of sound families.

Fundamental to any attack on the manifold problems regarding the nutritional, respiratory, and excretory relations existing between mother and fetus is a clear understanding of the intimate structure of the placenta. Many of the details are well established, but, surprisingly enough, one feature of paramount importance is among the least well understood. The human ovum is one that implants by erosion or burrowing, and it is a commonly accepted belief that both the arteries and veins of the material decidua are thereby tapped, the former pouring blood into placental sinuses into which the chorionic villi dangle. This classic view has the weight of many authoritative names in its support and only spasmodically has its validity been challenged. To be sure, vascular injections, in the hands of various investigators, have seemed to show the truth of this contention, yet there are several factors that, uncontrolled, can easily invalidate such findings. Among the pitfalls may be listed the following: (1) placentas already subjected to injury through labor contractions are not reliable material for study; (2) after death, necrotic changes cause vessels to be injured easily and ruptured during injection; (3) complications in interpretation may be caused by areas of extravasation in placentas sufficiently normal to carry the child to term; (4) breaking of the membranes or opening of the fresh uterus may result in an upset of the normal pressure balance so that maternal vessels of the maternal placenta are ruptured; (5) narrow fiords extend from the intervillous space into the decidua basalis, and some workers have mistaken these for arteries; (6) collapse of the villi may cause nega-

tive pressure in the intervillous space, drawing the injection mass out of the veins which drain it.

Opposed to the popular conception of the placental circulation are numerous facts. No one has ever traced an artery opening into the intervillous space of a young normal ovum. This is in contrast to the open communication of space and vein, and even space and capillaries. Early ova are bathed with a serum containing relatively few red corpuscles. Various investigators have failed to find blood in any amount in the intervillous space of placentas of the later months, provided trauma or other disturbances are absent. In those cases showing the presence of blood it can be best accounted for either by ruptured vessels (either fetal or maternal) or by backflow from the draining veins. Correlated with this is the repeated failure of everyone to demonstrate any significant number of arterial openings; in this connection one must be warned against the rupture of degenerated arteries during the first stage of labor.

An alternative working hypothesis of the vascular relations would emphasize that the openings of capillaries from the uterine arteries are so infrequent that only a trickle of blood comes from them. The intervillous space is a huge tissue space filled mostly by a fluid passing out from the decidua basalis, and in the last half of pregnancy from the myometrium as well. These edematous maternal tissues are traversed by capillary connections which serve as direct communicating channels between arteries and veins. The intervillous fluid is drained away by uterine veins, especially abundant at the placental margin. Such drainage is facilitated by rhythmic uterine contractions, while the fluid is also agitated by volume changes in the chorionic villi reacting to fluctuations in the fetal pulse.

Much remains to be done. The contents of the intervillous space must be studied directly and this can be done upon human material, supplemented by studies upon Old World monkeys and anthropoid apes. Such studies must be pursued by chemical, physiologic and histologic methods. The rhythmicity of uterine contractions should be investigated with respect to its possible rôle in propelling the intervillous fluid. Identification of lymphatics in the endometrium, and especially in the decidua basalis, should be established and their relations to resorption, edema and the spread of malignant growths clarified. The relations of every vessel of the maternal placenta must be known for a series of unaltered placentas of all ages. Such material will also serve for other studies, such as the nature and origin of placental septa and the true volume of the intervillous space during the several stages of pregnancy.

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The relation of physiology to fetal and maternal problems can best be indicated by noting some of the striking gaps in our present infor-

mation. For example, the sterility problem is more important than that of contraception, and a large proportion of cases will yield when once the physiology of human reproduction is better understood. Knowledge of the physiology of menstruation is notably deficient in spite of the attention given the subject and its importance both in the care of sterility and in the alleviation of the complications of menstruation.

Many features in the biology of egg and sperm await elucidation. Included among these are the forces operating to cause the discharge of the follicle at the right time, the picking up of the ovum, its propulsion down the uterine tube, as well as the transport of the sperm upward.

Pregnancy changes in the genital tract are but partially understood. Major problems include the growth and multiplication of muscle cells and connective tissue, the rôle of the several parts of the tract in parturition, and the physiology and pharmacology of the smooth musculature. More specifically, the exact arrangement of muscle bundles, the possible presence of conducting bundles (like the atrioventricular bundle of the heart), the analysis of the various parts of the uterus, the innervation of the uterus, its behavior during pregnancy, with special reference to version of the fetus, and, finally, the action of the parturient uterus, which no one has yet fully observed in the human, all these are fertile fields for investigation.

The hormonal control of pregnancy changes in the uterus and mammary glands is a topic already actively pursued and in which startling new relations are rapidly coming to light, yet there is much still to be done, especially as regards the interrelationships.

Pregnancy alterations in the pelvic ligaments seem probable in the light of recent work. Although changes in the vagina and cervix in preparation for birth are fairly well elucidated histologically, the hormonal causes back of them are little known. Other hormonal problems deal with the relations of the organs of internal secretion to metabolism. The details of the Zondek-Aschheim and Friedman tests need working out.

The question of the permeability of the placenta should be pushed further to discover to what extent its activities are controlled by physical and to what degree by "vital" forces. The passage of hormones, including the possibility of an embryo hormone, and the passage of toxins and antitoxins enter into consideration here. The determination of the span of pregnancy and the cause of birth are practically unknown from the physiologic side.

The relation of the endocrines to maternal and fetal problems centers largely around the female sex hormones, and it is in this field that the greatest investigative activity is occurring. However, evi-

dence has accumulated so rapidly that much conflicting opinion as to interpretation exists. Additional experimentation and critical analyses of work already completed are urgently needed to clarify the general situation.

The influence of the follicular hormone in causing a periodic development of the uterus and vagina of mammals has been extended both chemically and physiologically. Important is the finding of enormous quantities of this hormone in the urine of pregnant women. The evidence that the active substance of urine is identical with that in the follicular fluid is mainly physiologic. Two pure crystalline compounds possessing estrogenic properties have been isolated from urine, and it is important next to isolate the active principle from the liquor folliculi to determine which of the two it may be. For what purpose large amounts of the follicular hormone are produced to appear in the blood and urine during pregnancy, is a pertinent subject of inquiry. At present only shrewd guesses can be hazarded.

Other questions to be asked are the following: What are the functions of theelin and triol in pregnancy? Do appreciable variations in the quantities of these substances excreted by different patients occur? Can such variations be correlated with the clinical condition of the patient? Can the hormone excretion be correlated with mammary gland development and subsequent milk production? Does administration of these hormones produce changes in the other glands of internal secretion, such as the hypophysis or thyroid?

The corpus luteum is known to elaborate an internal secretion which produces a progestational development of the uterus after the follicular hormone has played its part. It also is necessary to nidation and early development. In the guinea pig it assists the birth processes by relaxing the pubic ligaments. Questions to be answered arise: Is the tendency to premature births due to an improper functioning of the corpus luteum? How long must the internal secretion be supplied for a normal period of gestation? Does the supposed antagonism between the internal secretion of the follicle and corpus luteum actually exist? Chemically, what is the nature of the internal secretion of the corpus luteum? Is the corpus luteum concerned with milk production? Is there an interrelationship between the corpus luteum and the hypophysis?

Placental extracts of three types and with distinct properties have been recognized. They are: (1) the follicular hormone; (2) a fraction named emmenin; (3) a fraction possessing many of the properties of the so-called luteinizing factor of the anterior hypophyseal lobe. Some of the problems arising around these hormones are similar to those of the ovarian hormones. In addition, there are others: Are they formed by the placenta or merely stored there? In the latter instance are they withdrawn from the blood for protective reasons or for positive

action? Does the placenta produce substances concerned either with mammary development and lactation or with the suppression of ovulation? Are the follicular hormones obtainable from both ovary and placenta identical?

The anterior lobe of the hypophysis has been connected with a variety of functions. There is the relation to the attainment of maturity, both in body and sex glands. The luteinization of the ovarian follicles, the induction of premature ovulation are other features, both of which may also be produced through the urine of pregnant women. It also is assigned a rôle in the systems producing uterine bleeding and mammary secretion. Perhaps too many functions have been ascribed to the hypophysis; at least, all the alleged activities should be examined more critically.

Due to Zondek and Aschheim, the urine of pregnant women has been proved to contain three substances: the follicular hormone, the ovulation factor and the luteinizing factor. The test for pregnancy devised by these workers on mice has been shortened by Friedman with rabbits to twenty-four hours. The establishment of laboratories where such tests could be made would be desirable, and the education of physicians to the value of such tests should be undertaken.

It is unfortunate that the relations between man and microbes must place accent on the activities of malignant forms to the exclusion of much that is interesting and important concerning the excellent qualities of the good germs. Microbic disease may be transmitted to the offspring by implantation from either parent. Of parental implantations, both syphilis and tuberculosis must be recognized. Parenthetically it might be well to emphasize that Colle's law (that a woman may bear a syphilitic child and become immune to the disease herself), and Profeta's law (that an apparently nonsyphilitic child may be born of a syphilitic mother), are now known to be incorrect, since practically all children born of syphilitic parents and parents of syphilitic children are syphilitic, and the disease will become manifest sooner or later.

The three principal paths through which contagious disease may be acquired are: the respiratory tract (including the eyes and the lacrimal ducts), the gastrointestinal tract and the urogenital tract. The latter does not concern a discussion limited to infancy and early childhood. It is important to realize that, in general, the breeding place of bacteria that cause contagion is actually within the tissues of the sick person and the attack should be directed toward the destruction of bacteria within the host.

The principal microbic diseases of young children acquired through the respiratory tract are the exanthemas and the acute lung infections, including various types of sore throat. It should be emphasized that

less success has attended the struggle against respiratory diseases than against those that affect the intestinal tract. Antiserums, antitoxins and vaccines have not been very effective, except in some instances. Nevertheless, the shock of scarlet fever and epidemic meningitis has been materially lessened through their use, and smallpox and diphtheria might virtually be eliminated if mankind were sufficiently disposed to bring this to pass. One can predict that within a reasonable time the respiratory infections will be reduced strikingly. The urgent need for study of microbic respiratory infections should be re-emphasized. More loss of working time, more impaired efficiency, more suffering and more deaths are caused by infections of the respiratory tract than the totality of ill effects from all other sources combined. This conquest is the great problem confronting medical science today.

Unlike the respiratory tract, which is normally a germ-free system, the gastrointestinal tract is from the first hours of life a bacterial breeding ground. Half the weight of the feces consists of bacteria, and that this mass of thirty trillions represents the normal daily growth within the intestinal tract is evidenced by the fact that they are not of the same kind as those eaten with food. To multiply in this environment, a bacterium must meet three requirements: (1) it must thrive at body temperature, (2) it must withstand many antagonistic forces in the intestinal environment (e.g., enzymes, competition with resident bacteria, and reaction changes of intestinal contents), (3) it must not produce products sufficiently inimical to arouse latent defensive and offensive powers to the host's tissues.

Shortly after birth three principal varieties of intestinal bacteria establish themselves. They are: Bacillus bifidus, Bacillus acidophilous, and Micrococcus ovalis. They agree in not producing putrefactive products; all three ferment sugars, including lactose from which lactic acid is derived. Lactic acid is Nature's preservative, and in the alimentary tract of the nursling it restrains the growth of putrefactive, or of disease-producing bacteria, and adds much to the defense of the immature and vulnerable alimentary canal. Also, most pathogenic bacteria, in the presence of sugar which they can utilize, produce, not poisons, but lactic acid. Breast milk is admirably adapted for maintaining this supply of lactose. This protective action of the nursling's bacteria is evidenced in the better protection against intestinal infection by normal nurslings in contrast to the susceptibility of artificially fed babies.

Strangely enough, along with this goes a concomitant resistance to respiratory infections, although the reasons for this phenomenon are not fully understood. In a correlative fashion, a change to artificial feeding produces changes in the character of the intestinal flora both

as regards varieties and their chemistry, and such babies are more liable to suffer from microbic intestinal infections.

The nearer the milk administered to the artificially fed infant approaches human breast milk in composition and sterility, the nearer the artificially fed infant approaches in its general resistance and condition that of normal nurslings. Unmodified cow's milk increases the proteolytic and putrefactive bacteria and decreases the lactoacidogenic ones. If implantation in the intestinal tract is desirable, B. acidophilous is the one to use and not B. coli (as advocated by Herter) or B. bulgaricus (as advocated by Metchnikoff). However, this procedure is not ordinarily necessary since the same end may be achieved by suitable dietary modifications. The method is to reduce protein, increase carbohydrate and provide for feedings frequent enough to insure a continual supply of lactose.

Science has already achieved a remarkable conquest through a significant reduction in the incidence of acute infections. This is manifest in the lessening of both infantile and maternal illness and deaths. It has been most conspicuously successful in intestinal infections, which are transmissible by food, fingers, flies, and water. Infections of the respiratory tract have been more elusive. They are still captains in the army of death. They affect parents and child alike; their conquest is one of the great problems of the future. Venereal infection, too, has been reduced, but by no means overcome. Here education must play an important part.

For the future, much remains: the missing links in the biology of infection—the totality of events which transpire between the time the microbes leave their ailing host and reappear to infect new victims—must be sought for to make prevention perfect. New methods and procedures in the specific therapy of bacterial infections, especially in the group of the respiratory and meningeal infections, are urgently needed. Finally, the dissemination of reliable information and practice for the care of the mother, prospective and actual, and for the preservation of the offspring, is a national challenge.

An investigation has been made on the postmortem findings in 337 stillborn infants, 179 of which were males and 158 females. Fetal death due to maternal disease accounted for 10.97 per cent of the total; of these, 5.35 per cent were attributable to syphilis, while 4.45 per cent resulted from toxemia of pregnancy. Deaths of placental or funicular origin totaled 9.49 per cent, about equally divided between placenta previa, premature separation of the placenta, and prolapse and compression of the cord. Had placentas been studied, excessive infarction would probably have been found as a cause in some instances. Malformations incompatible with independent life totaled 10.98 per cent, of which anencephaly accounted for most of the cases. This percentage was probably unnaturally swollen by specimens of

anencephaly sent in from outlying towns. Birth trauma was the most frequent cause of death in this series (29.97 per cent), while the commonest injury was to the falx cerebri and the tentorium cerebelli, or both. It is probable that mortality from this cause could be reduced with better obstetric care, since 61 of the 101 cases were regarded as normal spontaneous deliveries.

In 15.43 per cent of all cases prematurity was considered the cause of death in the absence of any other explanation, but this is not satisfactory, except for those specimens born before the eighth month. The cause of prematurity itself is the greatest gap in our knowledge of stillbirth. The prevention of premature labor would reduce the number of stillbirths by at least 20 per cent. Postmaturity was designated as the cause in 1.18 per cent but this explanation is not satisfactory and hides our ignorance of the real cause. Specimens that were retained and became macerated total 16.02 per cent. the cause of death in these instances is unknown and none showed any evidence of syphilis. In approximately 40 per cent of all the stillbirths examined the cause of death was undetermined.

A similar postmortem study of 500 infants and children under eleven years of age affords some basis for determining the more important factors concerned in the death of young children. This is important because before preventive measures are instituted we should know what our most important problems are. It can be shown that the mortality is highest during the first day of life and that it decreases steadily thereafter. During the first week nearly all the deaths are due to prematurity, birth trauma and congenital malformations. After the first month, infectious diseases and infections are chiefly responsible.

The mortality from congenital malformations cannot be reduced appreciably. We have no knowledge of their etiology and the great majority are inconsistent with prolonged life. However, a few lives in this group may be saved by appropriate operations.

Premature birth is a problem of great importance. Many premature infants may be saved if great care and skill are exercised. Education of physicians and nurses in the care of the premature infant should be undertaken. However, the fundamental problem is the cause of premature labor. One knows that in a few instances labor is brought on prematurely by disease of the mother, by injuries and by physical overexertion; but, as a rule, no satisfactory cause can at present be established.

The deaths from birth trauma occur chiefly during the first week. The premature infant is more liable to sustain trauma than the full-term offspring, and the problem is, therefore, partly that of prematurity. It is known that violent uterine contractions, disproportion

between the size of the head and the birth canal, and instrumentation all tend to cause injury of the brain. No doubt there are other factors also. Possibly some lives in this group could be saved by closer study of the problem.

Malnutrition is no longer a factor of great importance. The modern science of infant feeding has had remarkable success in this field.

Accidental deaths occur largely in the older children of the group and are mainly due to automobiles. This is a problem for the community rather than for the medical scientist.

The acute infectious diseases take their toll chiefly after the age of six months. Very young infants apparently have some passive immunity from the mother, and are usually less exposed to contact infection. Diphtheria may be prevented by previous immunization. Quarantine against measles, pertussis and scarlet fever is not very effective because of the difficulty of distinguishing these infections from common colds in their early, most infectious stages.

A very high mortality results from nonspecific infections of the upper respiratory tract, such as common colds, pharyngitis (including tonsillitis), bronchitis, and bronchopneumonia. One of the common complications of colds and sore throat is otitis media, which often results in suppurative mastoiditis. This is one of the most dangerous infections of childhood. Another frequent complication of colds and sore throat, one which often results fatally, is bronchopneumonia. Research in the prevention and better management of this group of infections is greatly needed and should be encouraged in every possible way.

Cases of tuberculosis are all instances of contact infection in the home. The crusade against tuberculosis is gradually reducing the death rate from this disease.

In the community forming the basis for this study (Minneapolis) syphilis is infrequent in children but is somewhat more frequent in the stillborn.

The renal condition connected with toxemia of pregnancy and eclampsia leads to the recognition of four clinical types:

1. Patients with chronic nephritis preceding the pregnancy. These patients continue with signs of renal deficiency after pregnancy. They form the "nephritic" group.

2. Patients presumably healthy before pregnancy who develop albuminuria during pregnancy, in whom all signs and symptoms of renal disease disappear after delivery but do not recur with a subsequent pregnancy.

3. Patients presumably healthy before pregnancy who develop albuminuria during pregnancy, and in whom all signs and symptoms

of renal disease disappear after delivery but do not recur with a subsequent pregnancy.

4. Patients presumably healthy before pregnancy who develop albuminuria during pregnancy, but in whom all the signs and symptoms of renal disease persist permanently after delivery.

This grouping has proved useful; it is clinical in character and avoids the pathologic issue as to the histologic and pathogenetic characteristics of the glomerular lesions found in the patients of the fourth group. (It is assumed as a demonstrated fact that a chronic kidney lesion much resembling a chronic nephritis sometimes develops from the ordinary acute toxemia kidney.)

The first group of true nephritis, already established before pregnancy, imposes on us a relatively simple responsibility. At least, the question can be stated clearly: given an already incurable kidney disease, perhaps with well-preserved kidney function and fair life expectancy, does a superimposed pregnancy impose a too heavy burden upon the diseased kidney and hasten the downward course of the condition? For the most part this question might be answered in the affirmative, but the situation seldom presents itself in such a simple form.

In regard to the second group two questions arise: First, how many cases actually fall into this fortunate group? Second, how long does it take to recover quickly, and if not, can anything be done to secure a quick recovery? To the last part of the second question an indirect approach will be indicated presently. The first question as to the relative size of this most favorable group is answered very differently by different observers. The older teaching, which formerly was believed to be based on facts, was that toxemia with the first pregnancy produced a sort of immunity for subsequent pregnancies. Nevertheless, the justification of such an optimistic teaching seems considerably shaken by recent results, and Gibberd, for instance, is willing to place only about 50 per cent of all cases of albuminuria of pregnancy in this group. A renewed statistical inquiry in this country seems worth while.

As to the third clinical group two remarks can be made: First, this is indeed a very peculiar hypersensitiveness, the cause of which is obscure and will probably be found largely through chance. Second, some women belonging to this group remain in it for two or three pregnancies only, after which the condition fails fully to clear up and the patient passes into the fourth and least favorable group.

The fourth group, as defined, contains the word "presumably," which is included for two reasons: first, to emphasize the care needed in deciding between groups 1 and 4, and second, as a concession to pathologists, and clinicians as well, who were fond of arguing that a noninflammatory toxemia of pregnancy should not or could not de-

velop into a chronic glomerulonephritis. However, for all practical purposes, experience has shown that toxemia of pregnancy develops into a chronic type of kidney lesion, the clinical course of which may vary considerably. The limits lie between a heavy albuminuria without any other important symptoms, persisting for as long as twenty-eight years without leading to renal insufficiency, and a rapidly progressing, one might well say fulminating nephritis with extremely high blood pressure, severe retinal changes and rapidly failing kidney function, ending in uremic coma eight to twelve months after delivery. The fourth group is estimated by Gibberd to include as many as 10 per cent of all cases of toxemia of pregnancy; others offer figures somewhat lower.

These groups have to be considered from the point of view of the responsibility the physician and obstetrician must assume and *particularly from the viewpoint of preventing cases from entering group 4.* It is a commonplace that both in the second and third group there are considerable variations in the time required for the complete disappearance of all renal symptoms and the regaining of full health. There is nothing original in the statement that recovery from the renal damage of toxemia of pregnancy depends very little on the sparing and protecting treatment following the delivery, compared with what happened before labor. Also there is a rather general clinical impression to the effect that the duration rather than the severity of the symptoms of toxemia before the spontaneous or induced termination of the pregnancy is the single factor of greatest importance for a rapid or protracted recovery.

Banister recently stressed the importance of early recognition of the beginning toxemia, emphasized the importance of immediate and energetic treatment, and then stated: "I have an idea that prolonged treatment defeats its object." He sets a time limit of some seven days for energetic treatment. Should recovery or definite improvement after this period not be noted, radical treatment should be chosen. At this point the following statement of Gibberd is important: "In allowing pregnancy to continue, we are exposing the mother to a very real risk of permanent renal damage for the sake of what may be a macerated fetus." The number of obstetricians and consulted internists sharing similar views is probably fairly large. Yet, the therapeutic view here presented is based both on that indefinite something cherished as clinical impression and on careful study of a large amount of material, handled to a considerable extent in a way contrary to what is now proposed. It is only actual results obtained in large series of cases treated according to this principle, that will prove the value of the procedure.

Further, the fact that in carrying out this principle a time limit of observation is made use of as the decisive factor, rather than specific

symptoms observed and evaluated during the observation period, serves to bring out the point that a field is here waiting for well-planned and correlated researches in clinics rich in material. By accurate and systematic recording of different symptoms biologic indications should be found for therapeutic procedures capable of preventing or reducing permanent damage. In toxemia of pregnancy as in few other diseases a multitude of valuable signs can be studied already, and with an intensified attack new ones are likely to be brought to light.

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The practice of modern obstetrics would be utterly impossible without the use of certain drugs, such as anesthetics, analgesics, oxytocics, antisyphilitics and antiseptics. The proper use of these drugs must rest on a thorough investigation of their pharmocologic action. The results obtained by experiments on animals must be confirmed by accurately controlled research in the clinic. There are still great gaps in the fundamental pharmacologic knowledge, and particularly in the action of drugs with respect to their action in obstetric cases.

The requirements for ideal anesthesia and analgesia in obstetrics are exacting. Pain should be relieved, without at the same time causing asphyxia and undue depression of uterine contraction. Further research is needed in this field with respect to the selection of the most suitable drugs, proper dosage and administration.

Accurate information is available on the oxytocic action of pituitary extract and ergot. Recent work has furnished satisfactory methods for the bio-assay of these drugs, and it is now urgently needed to determine clinical dosage, so as to secure the desired therapeutic effect without the production of untoward reactions.

With regard to the care of the use of organic arsenicals, bismuth and mercury preparations for the treatment of syphilitic mothers, the available chemotherapeutic knowledge is adequate for practical purposes. Further work dealing with the penetration of those remedies into the tissues of the fetus in effective parasiticidal concentration is called for.

The usefulness of silver nitrate in the prevention of ophthalmia neonatorum is well established. Efforts to replace less irritating preparations for silver nitrate may be worth while. The indiscriminate use of antiseptic douches is dangerous. Serious systemic poisoning may follow as a result of absorption of the antiseptic by the genitourinary tract. Further attempt should be made at the discovery of chemotherapeutic agents for gonococcus infections. Work of this nature is exceedingly difficult and requires good laboratory facilities, and well-trained specialists.

The present methods of resuscitation of the newborn infant are crude. The use of carbon dioxide-oxygen mixtures should be given a thorough trial.

Radiation therapy should rest on recognized principles of the basic sciences. A consideration of the nature of photochemical change leads to the view that the effective radiant energy is absorbed into the atoms of which the tissue is composed—a superassimilation. The initial effect is chemical activation. The resulting chemical change is the beginning of an ever-expanding stream of chemical and physiologic events. We do not observe the initial change; we observe only some more or less conspicuous physiologic or morphologic change which follows the exposure through amplification after a latent period. This obscures quantitative relations between exposure and effect. Nevertheless, it is possible and necessary to formulate basic principles of dosage, if for no other reason than to discover how empiric procedure differs from the theoretical. Such dosage determination depends on the area and volume of the tissues irradiated, the intensity and wave-length of the radiation used, and the duration of the exposure.

Since reproduction and lactation demand from the mother considerable sacrifice not only of activity but also of body substance it is essential to know what are the necessary nutritive requirements both for ordinary maintenance and for the increased demand during pregnancy and lactation.

From the standpoint of energy requirements of the adult woman there are required between 1,500 and 3,000 calories daily, depending on the basal requirements of the individual and the amount and intensity of muscular activity in which she indulges. In pregnancy the total energy production increases slightly, beginning at the middle of gestation and finally reaching the maximum of approximately 20 per cent above her basal value before pregnancy; such increases apparently represent the heat production of the newly formed tissue both of the fetus and the mother, the rate per unit mass of tissue not being materially changed. During lactation the caloric intake should be adequate for the ordinary maintenance requirements of the woman plus the energy loss in breast milk; the average mother will require from one-fifth to one-third more calories than for maintenance alone.

The protein requirement of woman is known to be greater during the period of pregnancy than during her usual active adult life, but it is difficult to make a precise determination of the protein requirements for any stage in the life cycle. Protein requirement under a specific set of conditions depends on the biologic value or amino-acid make-up of the protein, the number of nonprotein calories, and the

degree of tissue activity, the accustomed amount of protein taken, the physiologic and nutritive state of the woman. The requirements for human reproduction can only be stated tentatively and within wide limits: for pregnancy from 25 to 50 gm. in addition to the maintenance allowance of from 40 to 60 gm., and for lactation an additional 50 to 100 gm., depending on the quantity of milk produced.

Growth, pregnancy and lactation intensify the physiologic demands for minerals. From the practical dietary standpoint the problem is a most important one, especially in the United States, since it has been demonstrated that the American dietaries are inadequate in calcium, and in certain localities iodine deficiencies are very common. If a deficiency in minerals, namely, calcium, phosphorus, iron and iodine, occurs during the reproductive cycle, untoward effects may manifest themselves in the occurrence of relative infertility and abortion in the mother, and anemia, nutritional instability, tooth and skeletal disturbances appear in both mother and offspring. Although no exact determination of the mineral requirement throughout all stages of the human reproductive cycle has been made, it is estimated that from 1 to 1.5 gm. of calcium, 1.5 gm. or more of phosphorus, 18 mg. of iron, 0.014 mg. or more of iodine daily are required for the average woman during the pregnant period.

Animal experimentation has demonstrated that diets adequate in vitamin content for maintenance and growth fail to support normal reproduction and lactation. A quantitative statement of the vitamin requirements of man or his ability to store these factors in his tissues are not known with any degree of accuracy. It is apparent that if there is a deficiency in the food supply of the mother, either the maternal or the fetal tissue (or, perhaps, both) suffer. The efficiency of the transfer of vitamins from the maternal dietary to food for the fetus during prenatal life and to breast milk during postnatal life is not known for the human mother.

More problems present themselves with regard to nutrition than can possibly be enumerated here. One can merely point out that an earnest desire has been created in modern parents for sound information and advice on all problems of parenthood. Although it is generally recognized that an adequate nutritional program is of utmost importance during preparation for motherhood, pregnancy and lactation, for the good of both mother and child, only a fair start has yet been made toward supplying the kind of detailed information that would be of greatest use.

Little specific investigation has been carried out regarding the effect of maternal diet on pregnancy and the fetus. Statistical and experimental studies upon maternal diet and its effect upon the size and weight of the newborn indicate that actual starvation and se-

vere inanition do play a rôle in reducing the size and weight of the offspring, the production of fetal death and the premature termination of pregnancy. In moderate degrees of inanition and in simple control of maternal diet the fetus suffers no harm and is not limited as to size, weight or maturity.

Investigations on calcium deficiency show that this mineral is necessary for the proper development of the fetus and the maintenance of maternal weight during the pregnant state.

Vitamin A deficiency affects the fertility of the animal and is of great importance in maintaining resistance to infection. It may be of value as a prophylactic agent during pregnancy and the puerperium. Vitamin C is necessary for the successful termination of pregnancy and the health of both mother and fetus. It affects both in proportion to the severity of its deprivation, though the fetus and the newborn show less effects of the deficiency than does the mother. Vitamin D has been shown to be essential for the embryonic development of the chick and the fish. It is very probable that the susceptibility of the newborn to rickets can be lessened by adequate amounts of antirachitic substance in the maternal diet. Vitamin E is essential for the successful termination of pregnancy. Its absence produces degeneration of the fetal mesodermal structures, especially the blood-forming tissues, which ultimately results in fetal death and absorption of the embryo, membranes and placenta. The characteristic manifestations of vitamin E deficiency are difficult to obtain even in well-controlled experimental animals, unless the vitamin is practically eliminated from the diet. It is doubtful whether it plays an important rôle in fetal death and abortion in the human because of its widespread distribution unless there are unknown conditions in bodily metabolism which in some way interfere with its proper utilization. There is a suggestion, however, that the use of vitamin E as a therapeutic agent in primary sterility of unknown etiology may be of value. Experimental evidence indicates that the severity and rate of destruction of the embryo and membranes is dependent on the quantity of vitamin E in the diet.

Diet can be shown to bear a direct relation to the development of the bony pelvis of the adult woman. From maternity hospital records it appears that the incidence of deformed or contracted pelvis, although varying greatly with geographic location, climate, race, etc., shows a mean of about 15 per cent with about one-fourth of these resulting in difficult labor. Racially, negro women have an incidence about four times as high as white mothers. An etiologic classification of pelvic deformities is desirable from the standpoint of prevention but this is difficult because of lack of knowledge as to the exact

causes. Hereditary and germinal defects account for some. Adjacent developmental disturbances and overburdening the normal pelvis during childhood can probably account for others. It is agreed that rickets is a most important factor. Among the direct causes of rachitic deformities of the pelvis are body weight, muscular tension and retardation of bony growth in infants before sitting or walking. In older children the mechanical effects of the body weight with counterpressure become of major importance.

As in skeletal deformities of early rickets in general, there appears to be some correction in the pelvic deformities of early rickets, but these deformities doubtless largely persist into adult life. From several lines of evidence one may conclude that the probability is high that a large proportion of the adult female pelvic skeletal deformities may safely be ascribed to the persistent effect of earlier rickets.

Etiologically, rickets seems clearly to be a metabolic disturbance of complex nature, involving the process of calcification in general and of ossification in particular. This process requires several factors of which the most important are: (1) sunshine; (2) an internal secretion of the parathyroid glands that regulates the process in some unknown way; (3) the presence of calcium and phosphorus in proper form, amount and proportions; and (4) an antirachitic factor (vitamin D). Since the production of the latter is stimulated by the irradiation of a "provitamin" substance (ergosterol) both in the skin of the living body and in foods outside the body, the primary importance of sunshine becomes evident. This explains the prevalence of rickets in dark dwellings and cloudy climates, as well as the marked predisposition of the dark-skinned races.

Osteomalacia, which most recent investigators regard as adult rickets, osteoporosis in chronic starvation (as well as in dietary deficiencies), scurvy, osteitis fibrosa, etc., are other bone softening disorders of relatively slight importance, in comparison with rickets, in the production of skeletal deformities.

The desirability of eliminating human rickets is apparent. It would greatly reduce the number of cripples and, incidentally, the pelvic deformities constituting the hazards of childbirth. It would also avoid much ill health and many deaths due to the infections to which rachitic patients are markedly predisposed. Rickets appears to be a disorder readily preventable through hygienic measures. The apparent danger of dietary shortage of vitamin D in natural foods is obviated by exposure of the skin to sunlight and by the artificial irradiation of many foods. These measures have been shown to be practicable and efficient for the prevention and cure of rickets. Of course, proper dietary provision must also supply the necessary salts and other nutritional factors. Fortunately, the same factors for the prevention

and cure of rickets appear to be likewise effective in osteomalacia and allied disorders. The future outlook is, therefore, hopeful for the marked reduction of pelvic skeletal deformities, and for the elimination of the associated dangers of childbirth, through preventive hygienic measures during infancy and childhood.

Although human milk can fall short of being an adequate food to meet all needs of the baby, yet, in general, it may be said that the poorest quality of breast milk is superior to the less desirable types of artificial feeding. This conclusion is based on studies in which the nutritive state, rate of growth and development, and relative infant morbidity and mortality have served as indices.

If one inquires as to what the qualities are that make human milk superior, various facts come to light. With regard to protein, it is easily digested and occurs in the proper proportion and in a suitable medium for efficient utilization. The fat not only furnishes material for proper formation of tissues but also seems to function in the digestive processes of protein when it is present in proper amounts (from 3 to 5 per cent). Normal human milk carries a high percentage of lactose and is remarkably constant in amount but probably seldom causes digestive disorders. The amount of lactose seems sufficient for the production of heat needed by the child.

With regard to certain minerals (calcium, phosphorus, chlorine, sodium, potassium and magnesium) it appears that for optimum utilization for the nutrition of the child it is paramount that they be presented in proper combinations. Although it is impossible to say just what the combinations, relative proportions, and absolute amounts of these salts should be, it seems that normal human milk does provide them in a manner which is best adapted for the infant. The dietary rôle of other minerals, such as iron, copper and iodine, present in minute amounts, is little understood.

With regard to vitamins, it may be said that although there are many ways in which the young infant may fail to receive or utilize its daily quota of vitamins, many grow and develop without experiencing nutritive disaster when fed either breast milk or cow's milk. There is apparently a great factor of safety in vitamins A and B, even of human milk, but human milk may fail as a protective agent against rickets even when the maternal diet is notably sufficient and well balanced. The adherence of women throughout pregnancy and lactation to dietaries rich in fruit, vegetables, dairy products, glandular tissues and the like, together with an early presentation of vitamin-carrying foods to the infant, serve as the most potent factors in the production of a nutritionally stable child.

The influence of diet on the quality and quantity of secretion of human milk is another factor to be considered. The food of the mother, whether insufficient or excessive in caloric value, seems to alter the quality of the milk.

Differences of opinion exist as to whether the quality and quantity of fat in the dietary is a determining factor in the composition of milk and further studies are needed before definite conclusions can be drawn. It is agreed that dietary carbohydrate does not influence appreciably the lactose content of breast milk, but that it may affect the fat content. Dietary protein does seem to influence the nature and concentration of the nitrogenous substances and perhaps the fat of breast milk to some extent, but the data are too limited to permit of clear-cut conclusions. A liberal, varied diet, containing protein of good quality, enables the average mother to produce milk of satisfactory composition and is in accord with the dietary recommendations in the literature on human lactation. The mineral content of diet in its relation to that of the milk is a subject in which conflicting results appear in many cases. Information is now being collected on the influence of the liquid intake in variations in the composition of the secreted milk.

The mother does not constitute a potent factor of safety in supplying the vitamin requirements of the infant. Consequently there is a rather direct relation between specific vitamin deficiency diseases in nurslings and the same deficiency in the mother's diet. There are findings of an increase in vitamin C and D content of human milk after irradiation.

Specific foods do not seem to affect the quality of milk nor cause disturbances in the infant. Drugs appear not to be transferred to the milk in sufficient quantity to affect the infant adversely.

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With regard to psychic influences on the secretion of milk it is apparent that the psychic state of the lactating woman (including her innate disposition, intense emotions, mode of living, environment and extent of physical activity) do apparently play an important rôle on the quantity and quality of milk secreted. However, it is obvious that little is known regarding the extent or manner in which these factors act, or the relationship of mental phenomena and corresponding physiologic changes in the nervous system and mammary function. This paucity of present knowledge on the phases of this question of the psychic influence on milk secretion emphatically solicits coordinated investigation of all of these psychologic, sociologic, physiologic, and biochemical phases.

RECOMMENDATIONS

The entire fund of present information concerning what is desirable in safeguarding the health of mother and child rests, with a few exceptions, upon definite underlying principles rather than upon empiric procedure. These principles, in turn, are directly or indirectly traceable to discoveries furnished through the fundamental medical sciences. Although the frontiers of scientific knowledge are being pushed steadily backward by vigorous research in all these basic branches, there is, unfortunately, no concerted and primary effort toward attacking the peculiar problems of child health and protection. Instead, most of the useful discoveries of this nature have been made either quite without applied intent or else as the result of isolated and sporadic directed research.

The great need is for an organized, simultaneous attack through workers representing all the basic sciences. This might be effected by isolated groups, but obviously there would be distinct advantages in centralization. The program would be less spectacular immediately, but with more promise in the end, if attention were first directed toward filling in the existing gaps in the fundamental stock of information. What some of these important gaps are in each basic science has been indicated in the preceding pages. It should be noted that these several contributions, valuable as they are, can only be considered as representative summaries reflecting the opinion and interests of a particular individual. No attempt toward exhaustiveness was undertaken since placing the responsibility for a whole field of science on one person was obviously an impossible assignment. This lack of inclusive survey is, however, not important at the present time. Selective analyses, reflecting the personal background and interests of the contributors, have indicated many lacunae.

The general recommendation is plain. A representative commission, chosen from the best creative workers in the several basic medical sciences, should undertake a complete survey of the existing situation as regards fetal-maternal problems and then outline a comprehensive program of research. No great constructive advance can be made until it is clear where the problems lie and what their relation to the whole may be. This can then serve as a guide for those laboratories or individuals who may wish to undertake larger or smaller fragments of the plan. Ideally, there should be found financial support for a more organized attack, either parcelling out the work to isolated groups, or, better still, concentrating it in a central research institute.

THE WHITE HOUSE CONFERENCE

Program of the Sessions, February 18, 19, 20, 1931, Washington, D. C., of the Committee on Prenatal and Maternal Care

Dr. F. L. Adair, Chicago, Ill., Chairman*

Subcommittee I. Obstetric Teaching and Education of Physicians, Nurses, Midwives, Social Workers, and Laity

Section a. Palmer Findley, M.D., Rudolph W. Holmes, M.D.

b. George W. Kosmak, M.D.

c. James Robert McCord, M.D.

d. Robert L. DeNormandie, M.D.

Subcommittee II. Prenatal, Maternal, and Early Infant Care. By John Osborn Polak, M.D., Chairman.

Subcommittee III. Interested Organizations. By Robert D. Mussey, M.D.

Subcommittee IV. Factors and Causes of Fetal, Early Infant, and Maternal Morbidity and Mortality. By Hugo Ehrenfest, M.D.

Subcommittee V. Basic Sciences and Their Relation to Maternal and Fetal Problems. By Leslie B. Arey, Ph.D.

PRESENTATION OF REPORTS OF CHAIRMEN

1. Prenatal, Maternal, and Early Infant Care. By John Osborn Polak, M.D., Professor of Obstetrics and Gynecology, Long Island College Hospital School of Medicine.

Consideration of methods for consecutive prenatal, intranatal, and postnatal care for institutional and home cases of different racial groups in urban and rural communities.

DISCUSSION

Statewide Maternal Care and Racial Problems. By Adelaide Brown, M. D.

Methods of Providing Maternal and Infant Care in a Large Civic Community, The Medical Center. By Edward C. Lyon, Jr., M.D.

Conditions in Rural Districts Presenting Special Geographic Features. By Mrs. Mary Breckenridge, R.N.

Problems of Maternal and Early Infant Care in an Agricultural and Industrial State. By Arthur M. Mendenhall, M.D.

Prenatal and Maternal Care in a Large Urban Community. The Large Municipal Hospital. By Minnie E. Bea, R.N.

*For lack of space it is not feasible to print the names of all committee members. These may be found in the Directory of Personnel, published by the Conference.

2. **Interested Organizations. By Robert D. Mussey, M.D., Professor of Obstetrics, University of Minnesota (Mayo Foundation).**

Presentation of accomplishments and programs of various organizations of national scope having activities related to prenatal and maternal care.

DISCUSSION

3. **Factors and Causes of Fetal, Early Infant, and Maternal Morbidity and Mortality. By Hugo Ehrenfest, M.D., Assistant Professor of Obstetrics and Gynecology, Washington University Medical School.**

Consideration of antenatal causes and factors, intranatal causes and factors, postnatal causes and factors, morbidity and mortality statistics.

DISCUSSION

Immediate Care of the Newly Born Infant. By J. L. Baer, M.D.
Mortality and Morbidity Statistics. By Richard A. Bolt, M.D.
Comparative Statistics of United States and Foreign Countries. By Elizabeth C. Tandy, Ph.D.

4. Obstetric Teaching and Education of the Midwives. By James Robert McCord, M.D., Professor of Obstetrics and Gynecology, Emory University.

So long as midwives are necessary in some sections of the country and to care for certain racial groups, they must be trained in obstetric technic and work under medical supervision and control.

DISCUSSION

The Need for Schools to Train Midwives. By Ralph W. Lobenstine, M.D.
The Relation of the Midwife to the State Department of Health. By Felix J. Underwood, M.D.
The Relation of the Midwife to the Teaching Clinic. By Edward L. King, M.D.
The Menace of the Untrained Midwife. By Joe P. Bowdoin, M.D.

5. Obstetric Teaching and Education of Nurses and Nursing Attendants. By George W. Kosmak, M.D., Editor, American Journal of Obstetrics and Gynecology.

Report and recommendations relative to the teaching and education necessary to insure adequate nursing service to mothers and infants in homes and institutions by those engaged in this profession as institutional, public health, private duty nurses, or in other fields of nursing activities.

DISCUSSION

Obstetric Nursing for Institutions and Hospitals. By Lila J. Napier, R.N.
Obstetric Nurses for Private Duty and Other Services in the Homes. By Ann O'Loughlin, R.N.
Nurses for Public Health Work in Maternity and Infancy. By Calvina MacDonald, R.N., and Blanche Webb, R.N.
Trained Obstetric Attendants. By Edith V. Martins, R.N.

6. Teaching and Education of Laity and Social Workers. By Robert L. DeNormandie, M.D., Instructor in Obstetrics, Harvard University Medical School.

Report and recommendations regarding the subject matter and methods of instructing the laity and the stating of what and how and by whom the social worker should be taught about the problems which confront them in dealing with mothers and newly-born infants.

DISCUSSION

The Education of the Laity. By Paul Titus, M.D., and Mrs. Alfred D. Kohn.
The Teaching and Education of the Social Workers. By M. Pierce Rucker, M.D., and Kate McMahon.

7. Basic Sciences and Their Relation to Maternal and Fetal Problems. By Leslie B. Arey, Ph.D.

Report and recommendations of the committee relative to the part played by the basic sciences in the development of a program for child health and protection with suggestions for the proper fields of research requiring stimulation and support.

<div align="center">DISCUSSION</div>

Eugenics in Relation to Obstetric Problems.   By Paul Popenoe, Sc.D.

Embryology and Anatomy.   By George W. Bartelmez, Ph.D.

Pathological Studies on the Newly Born and on Young Children.   By E. T. Bell, M.D.

Bacteriology in Its Relation to Maternal and Infant Health and Life.   By Arthur I. Kendall, Ph.D.

Physiology and Reproduction.   By Carl G. Hartman, Ph.D.

Endocrines—Reproduction.   By Edward A. Doisy, Ph.D.

Nutrition in Relation to Maternal, Fetal, and Early Infant Health and Life.   By Icie G. Macy, Ph.D., J. A. Urner, M.D., and B. Raymond Hoobler, M.D.

Nephrosis and Nephritis in Relation to Maternity.   By Hilding Berglund, M.D.

Pharmacology and Obstetrics.   By Carl Voegtlin, Ph.D.

8. Obstetric Teaching and Education of the Physician.

1. Correlation of Instruction in the Basic Sciences with that of Obstetrics.   By Leslie B. Arey, Ph.D., Professor of Anatomy, Northwestern University School of Medicine.
    a. From Viewpoint of Basic Sciences.   By C. W. M. Poynter, M.D., Professor of Anatomy, University of Nebraska.
    b. From Viewpoint of Obstetrics.   By J. M. H. Rowland, M.D., Dean and Professor of Obstetrics, University of Maryland School of Medicine.
2. Undergraduate Education.   By Palmer Findley, M.D., President, Central Association of Obstetrics and Gynecology.
3. Graduate Education.   By Rudolph W. Holmes, M.D.   Associate Professor of Obstetrics, Northwestern University Medical School.
4. Education and Other Obstetric Requirements for Granting Degree of Doctor of Medicine, Licensing to Practice, and for Specialization.   By Walter T. Dannreuther, M.D., Professor of Gynecology, New York Post-Graduate Medical School.

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